EDITORIAL

DURING the month, Australia's TV plans moved forward in two important particulars.

Firstly, initial programs as such were telecast in Adelaide, where thousands of people gathered around shop windows to watch, just as they did in Sydney and in Melbourne in 1956.

If anything, enthusiasm was greater in Adelaide, whose citizens have been long tantalised by reports of TV doings in other States.

There is no doubt that Adelaide, Brisbane and Perth will absorb TV even more rapidly.

Secondly, the Postmaster-General announced plans for extending TV into 13 country areas in the Capital Territory, Victoria, Queensland and Tasmania.

In doing so he emphasised that priority would be given to applicants representing local interests rather than those of the commercial stations already established, and that local commercial licences shall not necessarily be limited to one.

This is very good in principle. It implies that TV investment shall be distributed evenly and that adequate control shall be exercised by the local people.

But it is only being realistic to recognise that no country TV station could get very far if left to its own devices.

In some way or another it must share in the bulk of program material whose quality has only been built up through the availability of world wide distribution.

There are many happenings in the major cities which vitally concern country people, and they will want to see them.

This means inevitable and close co-operation with major sources of program distribution, as now happens in radio.

It can be done by an interchange of telerecordings and the use of co-axial or micro-wave links when these are installed.

Soon we hope such links will be planned in addition to those announced between Sydney and Melbourne.

Experience has shown that the only firm basis upon which to build a good TV service is a good program, and nobody's individual resources can produce these.

John Moyle

Commercial TV stations have established such superiority in this field that it is good to see in the P.M.G.'s statement further encouragement for them.

INDEX

	Page
Flying Saucers Could Be Real	3
Amateurs Case For Survival	4
Height Record For Model Plane	9
New Radiation Research Plan	11
New Thermionic Heat Converter	13
The Sydney-Melbourne TV Link	15
Science of Chemurgy Reclaims Waste	16
Technical Review	21
News and Views	29
Stereo Tone Control	32
A Reader Built It	41
How Radio Telescope Is Used	43
Design of Distortion Meters	48
Stereo Monster Sounds Superb	55
Course In Television	59
1959 Karset	64
Here's Your Answer Tom	77
Hi-Fi Crossover Networks	80
The Serviceman Who Tells	85
Trade Review	91
Let's Buy An Argument	96
Off The Record	102
Short-Wave Notes	112
The Amateur Bands	113
Answers To Correspondents	125

RADIO ★★ TELEVISION AND HOBBIES

A NATIONAL MAGAZINE OF RADIO, TELEVISION HOBBIES AND POPULAR SCIENCE

EDITOR
JOHN MOYLE
S.M.I.R.E. (Aust.)

TECHNICAL EDITOR
NEVILLE WILLIAMS
M.I.R.E. (Aust.)

TECHNICAL STAFF
MAURICE FINDLAY
A.S.T.C.

PHILIP WATSON
A.M.I.R.E. (Aust.)

W. YASHIN

MERVYN HUDDLESTON

Vol. 21 No. 3

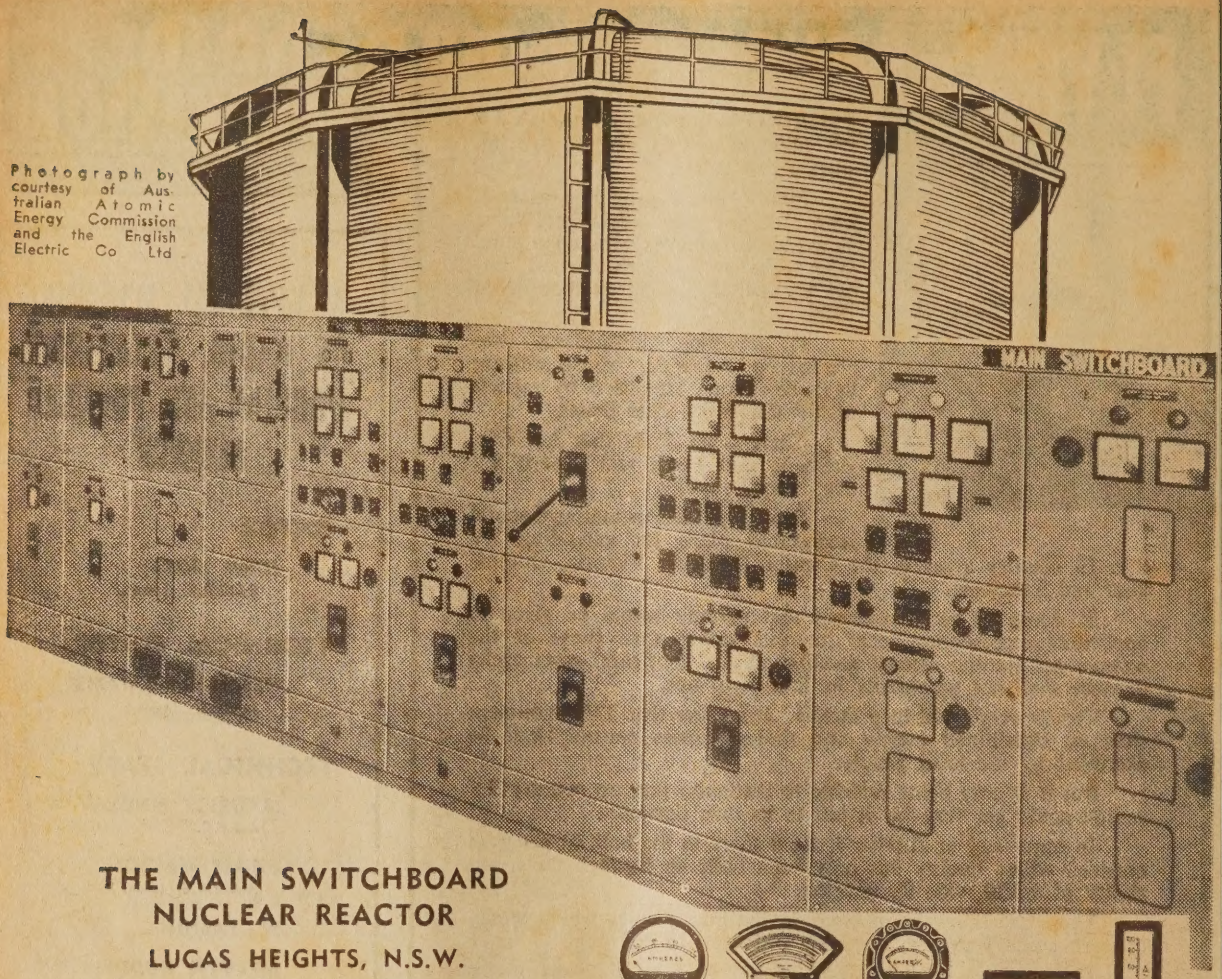
SUBSCRIPTION RATES

C'wealth, N.Z., N. Guinea, Fiji — £1/10/- p.a.
United Kingdom — £1/13/- p.a.
British Empire — £1/15/- p.a.
Foreign —£1/17/- p.a.

Phone ---------- B0944

OUR COVER PICTURE

Modern disc recording demands the highest quality of equipment and precision workmanship. Here an engineer adjusts a Neumann automatic recorder, levelling its turntable to the closest tolerances.



Photograph by courtesy of Australian Atomic Energy Commission and the English Electric Co Ltd

THE MAIN SWITCHBOARD NUCLEAR REACTOR

LUCAS HEIGHTS, N.S.W.

This switchboard is exclusively equipped with a representative range of PATON INSTRUMENTS, including: Ammeters, Voltmeters, Wattmeters, Power Factor, Frequency Meters, and Synchroscopes, etc.

PATON ELECTRICAL PTY. LTD., manufactures the MOST COMPREHENSIVE range of Electrical Measuring Instruments in Australia, covering:

ALL TYPES: Volt - Amp - Watt - Var - Power Factor - Frequency Synchroscopes - Pyrometer - Light Meters - Meter Relays, etc., from 1½" to 8". Square, Round, Edgewise, Flush, Projection and Sector, as illustrated, including:—

CONCENTRIC SCALE (250 degrees) METERS, AC-DC and Dynamometers.

SUPERB QUALITY, QUICK DELIVERY, LOW PRICES.
Technical and Service Facilities.

PATON ELECTRICAL PTY. LTD.

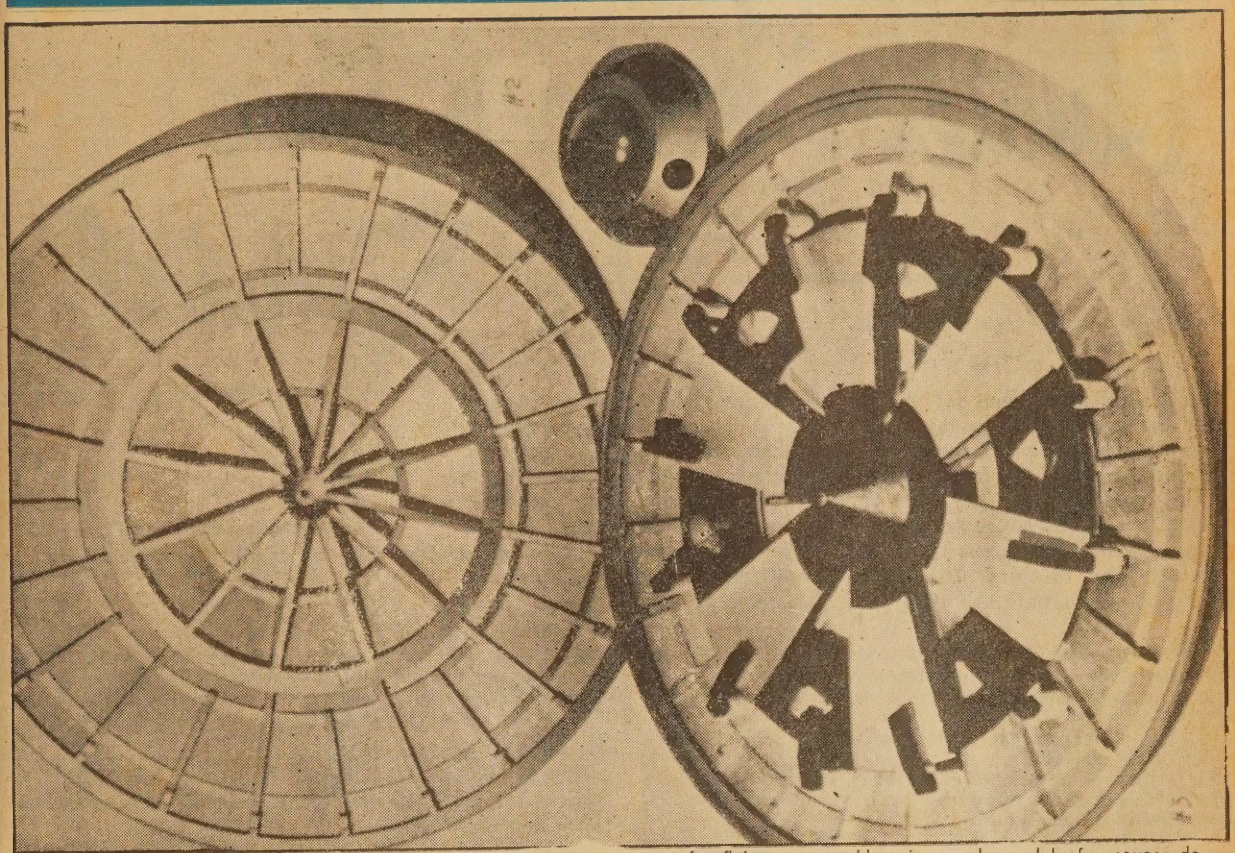
Ashfield, Sydney **UA0381 (5 lines)**

REPRESENTATIVES:—MELBOURNE: R G Holloway, 299 Little Lonsdale St. BRISBANE: K H. Dore & Sons, 465 Adelaide St. ADELAIDE: E. Bown Ltd., 131 Wright Street PERTH: Carlyle & Co. Ltd., 915-917 Hay Street. TASMANIA: Gebbie Harvey Pty. Ltd., 76 Wellington St., Launceston. NEW ZEALAND: Carrel & Carrel Ltd., 41 Shortland St., Auckland

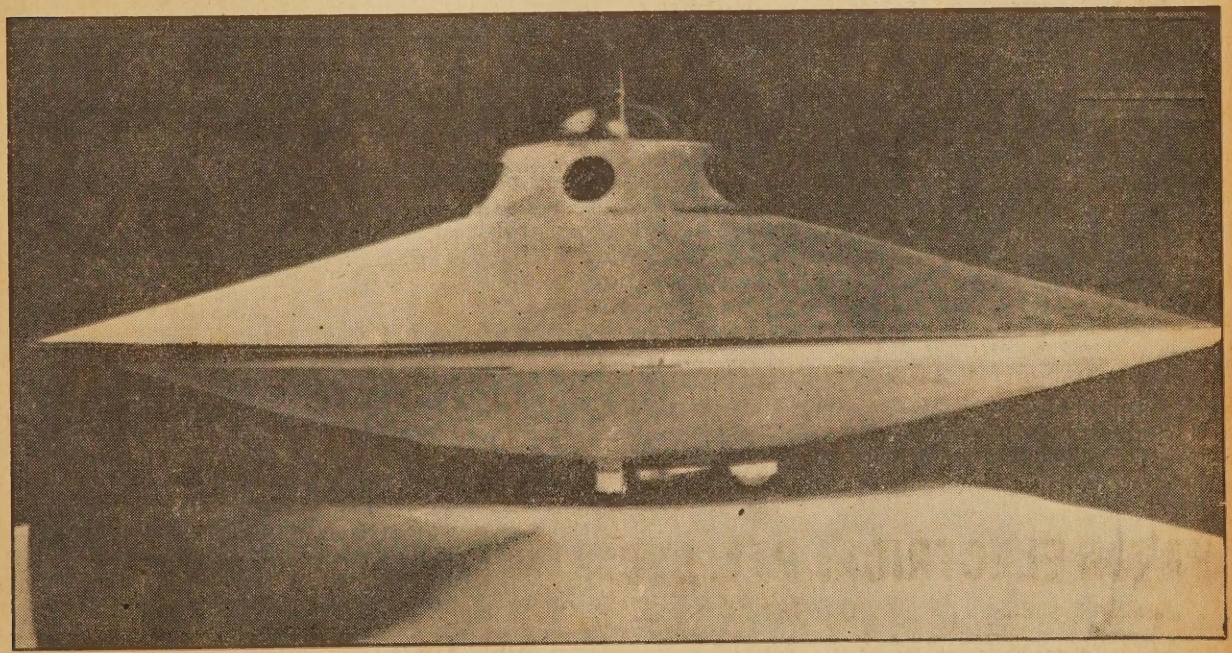
SOLE AGENTS

Elmes - Staub (Switzerland) Inkless Recording Instruments. Watchstones (Switzerland) Jewel Bearings. Megatron (London) Photo Electric Cells.

FLYING SAUCERS COULD BE REAL



Maybe we don't have to worry about outer space invasions to account for flying saucers. Here is a scale model of a saucer designed in America by Otis T. Carr. (1) is the top section, (2) the pilot's compartment and (3) the lower section containing the counter-rotating elements of the propulsion system.



A side view of the completed scale model of the OTC-XI spac craft. The lower section carries the power unit, a Utron electric battery and counter-rotating elements. The upper section contains the passengers and pilot. A 45ft flying model should be completed this year.

Amateurs Make a Case — For Survival

Australia's submissions for the next frequency determining conference at Geneva contain in their initial stage proposals to reduce several amateur bands which have already reached an irreducible minimum. These proposals, the implications of which are further analysed on page 113, are being resisted by the amateurs, who have been supported in their fight by interested members of the Federal Parliament. Further curtailment of amateur bands may well render some of them useless in the years to come, unpardonable treatment for men who represent a national asset, and the pioneers of radio.

by The Editor

RADIO amateur transmitters all over the world are viewing with great concern the forthcoming conference of the International Telecommunications Union which commences at Geneva on August 17th of this year.

This is a conference, held approximately every 11 years, at which delegations from the various countries of the world meet to review the allocation of radio frequencies for every kind of service—broadcasting, television, navigational aids, communications and so on.

What is decided upon at Geneva will be binding for a further 11-year period on the countries which sign the agreement.

Among the frequency bands to be determined are those used by radio amateurs. In Australia, as in other countries of the world, amateurs are anxiously awaiting the outcome of the conference, at which it is feared some of their ether space will be seriously curtailed.

The first review of frequency usage in Australia was made by a body called the Frequency Allocation Sub-committee, known as FASC. Its recommendations were passed through appropriate channels, and became the initial proposals sent to Geneva on behalf of the Government for incorporation in a Volume of Proposals. This document correlates similar proposals from all the countries of the world, and is to be distributed to them to form the agenda of the Geneva meeting, which, through its machinery of sectional conferences and discussions, produces the final schedule.

Naturally enough there is great pressure from the many users of ether space to obtain better facilities for themselves to accommodate their ever-growing responsibilities, and it is inevitable, therefore, that some will gain and some will lose in an effort to make a workable agreement.

AMATEURS HAVE NO VOTE

This series of conferences does not provide that the amateurs have any direct say or vote in any suggestions which may be made to alter their frequency bands, and they are the only international frequency users to suffer under this disability. Unless, therefore, they take steps to make their voice heard by those who decide their fate, there is grave danger that their claims will be overlooked and given the lowest priority.

The danger in this instance is considered so great that the Wireless Institute of Australia, the official amateur body in this country, has organised a fund to which a large number of amateurs have subscribed to send one of its members to the conference at Geneva.

The Postmaster-General, whose department is charged with administering radio services, has invited this representative to accompany the Australian delegation to Geneva as an accredited observer and adviser on amateur matters, and the institute has done me the honour of appointing me to carry out this work.

This means that I will be in attendance at Geneva for a period of approximately three months from August 17, together with other members of the delegation representing the P.M.G.'s department and major frequency users.

For this reason, apart from the fact that I have been an amateur for nearly 30 years, I have a special interest in the events which are taking place, and am prompted to record some impressions of the amateur position which I think you should know.

Many other representatives of amateur societies of the world will also be in Geneva at this time, some of them also attached to their national delegations. Naturally they will hold many discussions among themselves on purely amateur matters, but all will be seeking to influence the conference in their favour by every available means.

WHO ARE THE AMATEURS?

A radio amateur transmitter is a private citizen who, having passed the necessary examinations, is granted a licence to transmit and receive by radio using either morse code or radiotelephone, and to experiment in certain cases with other means of transmission such as television. He is not permitted to receive any reward as a result of his activities, or to pass messages on behalf of others or which would normally be sent through established commercial channels. His work is confined to certain bands of frequencies scattered throughout the short-wave and ultra-short-wave spectrum, and these bands in most particulars are the same for licensed amateurs in all countries of the world.

The first experiments in radio were carried out by amateurs, although in those early days there were no regulations, restrictions or licences. Their discoveries soon proved to have commercial value, and certain promising frequencies, such as those now used for broadcasting, were taken over by the growing number of commercial services. The amateurs were relegated to the frequencies below about 1,500 kilocycles which at that time were considered valueless.

But the amateurs, by this time a more clearly recognisable body of experimenters, soon showed that their new territory was even more valuable than the old. Eventually they were confined to narrower channels which were set down

in rough harmonic relationship throughout the short wave and ultra-short wave bands.

In these years of initial examination of the radio spectrum, the amateur contributed completely vital and fundamental knowledge upon which much of present-day radio technique is based. As the concentration of radio knowledge became more intense and financially supported, his work, although still valuable, could not compete with the new masters of radio, who now occupied the frequencies he pioneered.

Nevertheless many of the best brains of the radio industry were and still are amateurs, most of them active, and the indirect influence of amateur activity remains a potent force.

But, despite their honoured history, amateurs in this and other countries do not rely solely upon pedigree for their claim to a place in the sun. They have organised themselves into active and virile societies to help each other and to further the standard of their arts. In Australia the Wireless Institute claims a big proportion of active amateurs as members, and has divisions in each State and in New Guinea.

Most of these operate training classes for new recruits, they are active in the Civil Emergency Organisation with their own WICEN emergency network, they have frequently helped to save lives and property particularly in the flood disasters which have struck the State of New South Wales over the years. They have their special study groups which concentrate on various aspects of their work, and many are experimenting and using modern techniques such as television and single-sideband transmission.

GOODWILL AMBASSADORS

Their continuous and entirely non-political intercommunication on an international basis—their DX activity—is legendary, and in recent years their success in this field using VHF, previously considered unsuitable for such work, has once again helped to trigger-off new and valuable techniques now being exploited commercially and for defence.

Their world-wide assistance in the Geophysical Year, and in tracking satellites, has been officially commended in many instances, so that, even today, they contribute to the process of research over a wide field.

All of this is guided in Australia by the voluntary and unpaid efforts of elected officers, and with the assistance of many of their number who are highly skilled and professional engineers.

As a matter of interest, the Wireless Institute of Australia is the oldest amateur society in he world, with an unbroken history which commenced in the year 1910.

Although there are 3,800 licensed amateurs in Australia, other countries have even larger numbers. In America there are about 150,000, supported by the powerful American Radio Relay League, and they are highly valued by the community. Great Britain has about 9,000, and nearly every country in the world, including Russia, has its amateur fraternity.

Why then should amateurs find it necessary to fight so hard for the right to survive and occupy a reasonable amount of frequency space?

The first reason is that, because the terms of the licence confine them to a strict amateur status, they have none of the weapons which automatically are acquired by powerful commercial and Government-operated services. They do not fill the revenue of Government departments, they do not indulge in propaganda for the benefit of other nationals, they do not form an organised part of navigation or defence or international telephone systems.

The very conditions under which they are legalised have stripped them of the ability to bring pressures in high places to stiffen their claims.

When conferences, such as those held by FASC, examine the sources of possible new frequencies, amateurs are dangerously vulnerable, an easy mark, and with no direct voice to counter a possible assault.

AMATEUR SERVICE IS UNIQUE

Amateurs generally, and certainly the Wireless Institute, are well aware of the enormous difficulties facing committees such as FASC because they themselves use the ether and often suffer badly from those who illegally use their bands. They know only too well the process of attrition and congestion which the other services must face.

But they feel, and not without justification, that the services whose representatives sit in conference to carve up the frequency bands do not understand fully the unique features of amateur operation which are quite unlike those of any other, and are not even to be judged by the same standards.

They believe that these services are not actively interested in amateurs, that they do not appreciate their value to the community, and consequently afford them the lowest possible priority when decisions are made.

As they have no vote in the ultimate outcome, and are given, initially at least, only a superficial hearing, amateurs feel that their only defence is to make their case known to the community in general, believing that they can establish an irreducible minimum in frequency allocation beyond which they should not be degraded.

And, they believe that in most instances this minimum has been reached. Beyond it lies the danger of ultimate extinction.

THE AMATEUR'S CASE

Many of the strongest points in the amateur's case are of a technical nature only to be fully appreciated by those with a knowledge of such matters. But there are some, and sufficiently strong in themselves, which everyone can appreciate.

The basic justification for a higher priority in frequency planning is the fact that amateurs represent the only segment in the ether which the private citizen can claim as his own.

Every valuable facility available to the community has a protection written into its control to prevent its total use or monopoly by public and commercial services.

Land is perhaps the most valuable public commodity, but no city is foolish enough not to set aside some of its best land as public domain, with which it builds parks and gardens for the use and enjoyment of the people.

The only comparable portion of ether space which can parallel this example is that section set aside for amateurs. They represent a basic democratic right of the people as a whole to make use of the radio spectrum which is available for us, and in principle their rights are written into the principle of common law, irrefutable and inviolate.

In my view, there is no principle with a higher priority than this.

Many of the claims put forward by other services for confiscation of amateur bands, including some which are urged on an international basis, can be questioned in the public interest, if not by the convenience of those who operate them.

An outstanding example of this is found in short wave broadcasting, which has whittled away the traditional and extremely important amateur band commencing at seven megacycles until it is effectively a mere 100 kilocycles wide, and which, despite its exclusive amateur allocation, is regularly and systematically raided by illegal broadcasters, some of them uncomfortably near home.

SHORT WAVE BROADCASTING MESS

The truth is that short wave broadcasting badly needs a clean-up.

No section of the ether is subject to greater and more stupid waste, or is of so little value to the alleged army of listeners.

As soon as a powerful transmitter, aiming its programs to a foreign country, includes propaganda material in its broadcasts, it is liable to deliberate interference by an equal or more powerful jamming station whose purpose is to render it unintelligible.

So yet another station goes on the air to remedy the matter from possibly a more strategic position, only to meet a similar fate.

As a result we find myriads of channels, hopelesly involved in the battle of power and unpleasant noises, but so tied up with prestige and politics that there is no solution to the incomprehensible mess.

Apart from this process, there is a multiplication of overseas services whose only justification can be primarily that of propaganda. All are aimed at ensuring that their collective national voices are heard from all points of the compass, many are highly duplicate and unnecessary. It is inconceivable that they should have any great value or justification purely as a source of entertainment, and it is extremely doubtful whether the occupancy of all this ether space is heard by more than a small fraction of the people as a whole.

And yet short wave broadcasting is a major threat to amateurs, who probably spread more valuable and effective messages of goodwill than any other service.

In operating these short-wave stations, few nations consider themselves bound by their contract to observe amateur band limits as implied in their signatures to the Atlantic City agreement made at the last I.T.U. conference held in 1947.

Two Mullard Tubes

2¾″ general purpose tube
DG7-5 (CV2175)

The DG7-5 has a low operating voltage and is intended for symmetrical deflection. It is being successfully employed for wave form monitoring and for inexpensive oscilloscopes.

5½″ x 1½″ flat A-scan tube
DG16-22/7APH1 (CV2352)

The screen of the DG16-22 measures 5½″ x 1½″. A number of these tubes can be easily stacked to provide multiple displays in confined spaces.

Mullard

COMMUNICATIONS AND INDUSTRIAL VALVE DEPARTMENT

MULLARD-AUSTRALIA PTY. LIMITED
35-43 Clarence St., Sydney — BX2006 592 Bourke St., Melbourne — MU2366
Associated with MULLARD LIMITED, LONDON, MULLARD EQUIPMENT LIMITED, MULLARD OVERSEAS LIMITED

M73

Amateurs have grown tired of drawing attention to systematic encroachments on their bands, and by the regularity with which their protests are ignored.

The truth is that, short of declaring war, there is no way of enforcing the terms of agreement if any country decides to ignore it, and there are innumerable examples of such deliberate violation.

The most serious result of a reduction in amateur bands in any particular is that, once lost, they will never be regained.

It is inconceivable that, having established transmitters and services to occupy the newly acquired ether space, the nations of the world would ever vote to remove them, even if it were administratively or financially possible to do so.

Thus, when an amateur band is curtailed, and the reason for so doing is considered valid, there is no reason why the process should not continue as long as the alleged justification exists, and this can only lead to complete extinction of amateurs altogether, or to their discouragement and attrition through eventual strangulation.

NATIONAL ASSET

The loss of the amateur bands, or their serious curtailment and restriction to certain poorly valued frequencies, would be a national tragedy. They are an unrivalled training ground for technicians and engineers of the present and the future, providing facilities and experimental opportunities found nowhere else.

Too soon have we forgotten the immediate response of amateurs to the call of the fighting Services during the last war. In the R.A.A.F. to which I belonged, I know from personal experience that most of the senior radar and signals officers, and many other ranks, were amateurs, or men who had obtained their first introduction to radio as amateurs.

The Director of Radar and Telecommunications was himself a prominent prewar amateur, and the heads of the directorate, which was a huge organisation, were very largely amateurs who had entered the Service through the R.A.A.F. Wireless Reserve, an amateur pre-war organisation.

In both the Navy and the Army, the same general picture prevailed, and there are many who believe that the radio facilities of all three would have been severely prejudiced without the initial influx of amateur-trained personnel.

WHAT THE AMATEURS ASK

Although announcement of the proposed cuts in amateur bands which have been included in the initial Geneva submissions was long delayed by the P.M.G., it is now known that reductions which the amateurs consider excessive are proposed in the bands of 3.5, 7, and 14 megacycles, and some further and most serious curtailments in the VHF bands in which so much of the future of radio lies.

In support of these cuts, it has been said that the amateurs do not use their bands to full capacity, that they could lose frequencies without prejudice, and that their priority is not strong enough to withstand the pressures generated in other services.

The amateurs deny all these claims. They consider it almost impossible to assess what is full band-occupancy, remembering that propagation conditions prohibit any valid monitoring except on a scale much wider than has been carried out. They say that, because private citizens cannot spend hours on the air when normally they are earning a living, there will be many times when the bands must carry only a light concentration. They point out that, unlike the commercials, they are not allowed to use V-wheels, or to leave their carriers on the air to hold their channels not otherwise employed.

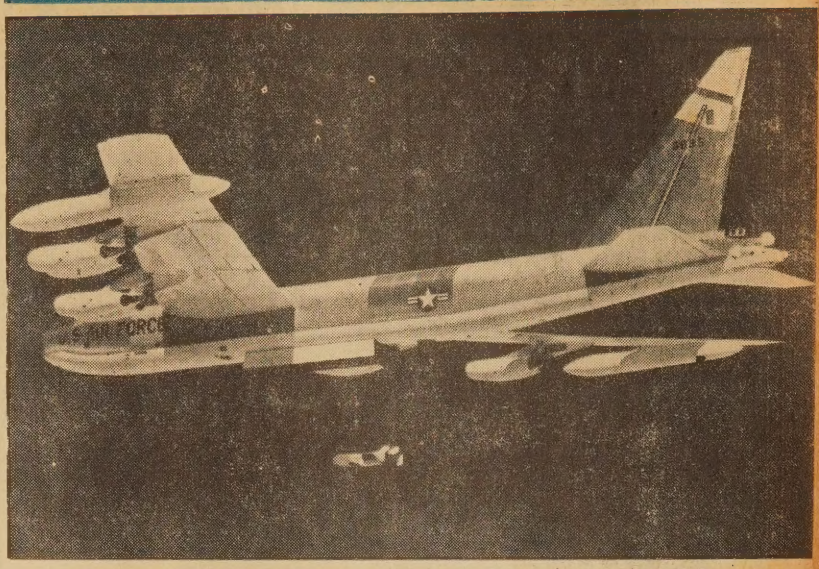
They remind other services that amateurs are steadily increasing in numbers, and should, in fact, be encouraged to do so by the authorities. They point out that, by reducing bands now, there will be even less room for the new licences during the next 11-year period, after which, presumably, further cuts can be expected unless a radical change in thinking takes place.

They believe that their record, the present achievements, their promise the future, and their rights as the la unfettered users of the ether justify as ing for full recognition of their co munity value, and a re-examination the threatened setback to which th have, initially at least, been subjecte

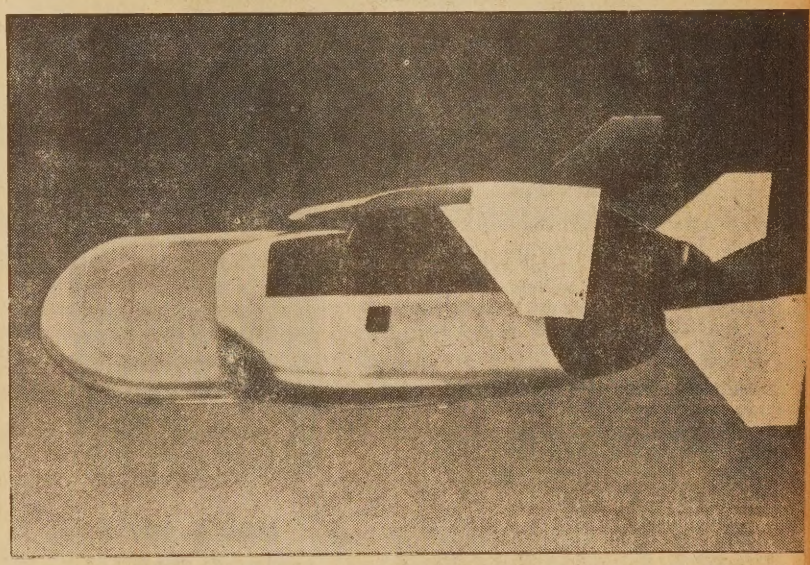
The gathering at Geneva is a co ference, and it is inevitable that ma second thoughts will emerge, and mo fications made to the initial proposa

The amateurs have a strong case f more sympathetic and positive help fro the country's representatives who w decide their destiny. In doing what th can to raise their recognised status the community at this time, they a only exercising their rights as citize They demand that the voice of a dese ing minority should be heard.

DECOY MISSILE TAKES THE AIR

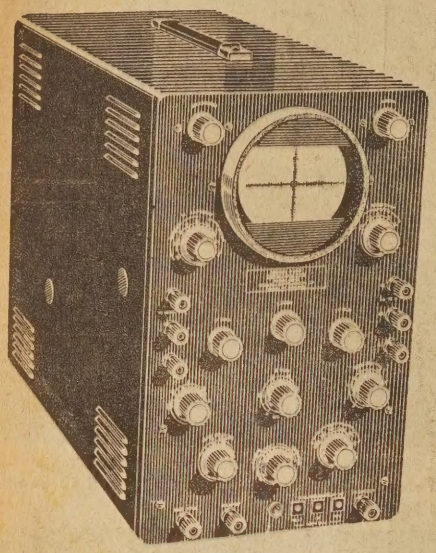


The GAM-72 Quail Decoy Missile, developed and manufactured by McDonnel Aircraft of St. Louis for the U.S. Air Force is shown being launched by a B-52 bomber of Strategic Air Command.



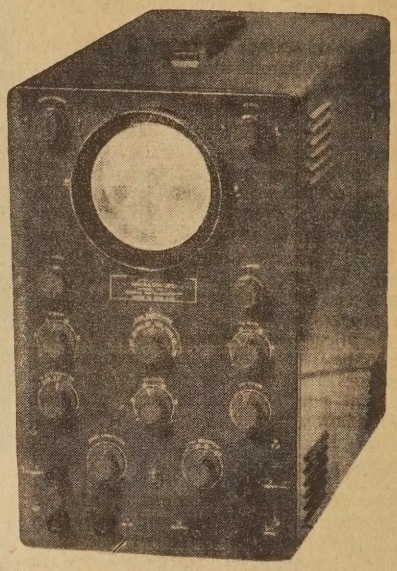
Close-up of the Quail. It is powered by a General Electric J85 engine, a lightweight turbo-jet with a thrust of 2,000 pounds.

KIT SETS BY COSSOR



Cossor Instrument Kits are complete to the last detail. Each high quality component is referred to in the comprehensive and profusely illustrated construction handbook and the finished instrument is professional in appearance and performance, and is light in weight.

This equipment will be found to be invaluable in Technical Colleges, Service Departments and in Industry generally for a wide variety of applications.



MODEL 1071K (Above)

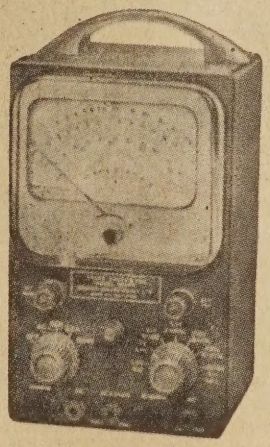
MODEL 1045K (Above)

Double-Beam Oscilloscope Kit Set

When assembled, this model is a high grade double-beam oscilloscope, incorporating five printed-wiring boards and ten miniature valves. Features include a wide range of time-base speeds, fly-back blackout and an X amplifier for internal or external voltages. The two Y amplifiers (d.c. to 3 Mc/s) are identical and preceded by switched attenuators. Facilities for intensity modulation are provided.

PRICE £117/10/-

(F.O.B./F.O.R. Sydney)



MODEL 1044K

PRICE £29/-/-

(F.O.B./F.O.R. Sydney).

Single-Beam Oscilloscope Kit Set

This single-beam oscilloscope kit can be assembled to provide a useful instrument incorporating two printed-circuit boards and nine miniature valves. Features include X and Y amplifiers of high gain and broad frequency response a wide range of time-base speeds, fly-back black-out, a calibrating voltage and facilities for intensity modulation.

PRICE £74/17/6

(F.O.B./F.O.R. Sydney)

Valve Voltmeter Kit Set

This kit can be assembled to provide a robust and compact instrument. It is designed for accurate measurement of d.c. potential, a.c. r.m.s. and peak-to-peak potentials and resistance. The valve voltmeter has many advantages over the non-electronic volt-ohmmeters. The most important of these is its low loading of high-impedance circuits such as resistance-coupled amplifiers, oscillator grid circuits and a.g.c. networks.

PRICES QUOTED EXCLUSIVE OF SALES TAX—FREIGHT COSTS EXTRA INTERSTATE

JACOBY MITCHELL
EQUIPMENT FOR INDUSTRY AND RESEARCH

JACOBY, MITCHELL & Co. Pty. Ltd.

469-475 KENT ST SYDNEY — PHONE MA8411

MELBOURNE OFFICE: 113 BRIDGE RD., RICHMOND, VICTORIA—JB5100. NEWCASTLE OFFICE: 135 BEAUMONT ST., HAMILTON.

DISTRIBUTORS THROUGHOUT AUSTRALIA

HEIGHT RECORD FOR MODEL PLANE

The model aircraft sets off on its record-breaking flight.

Colin Stones adjusts the diesel motor which powered his model.

An Australian altitude record for a model aircraft was set on April 9 when a diesel-powered model made by 23-year-old Colin Stones, a Melbourne aircraft welder, soared to well over 14,000ft in a flight from an airfield at Berwick, about 30 miles from Melbourne.

CONDUCTED under the auspices of the Victorian Model Aeronautical Association, the flight was checked by two official observers, Keith Hearn and Robert Greenhill, appointed by the Federation Aeronautique Internationale. An Army radar unit was on hand to track the aircraft and it followed it to 14,250ft before cloud combined with excessive range caused the model to be lost.

About six years ago Colin began building power models, but it was not until early last year when he read of a new altitude record (16,741ft) established by a Russian experimenter that he decided to work on a large model with which he might challenge existing record holders.

Construction of the model for the record attempt occupied more than two months. The design was his own, perfected after experiments with an earlier (and smaller) model which had reached over 6,000ft.

With a wingspan of about six feet, the model had a chord of eight inches, giving it a high aspect ratio (nearly 9) as an aid to climbing ability. Total wing area was 34.1 square decimetres, with a tail area of 10.9 square decimetres.

BALSA MODEL

The model was made almost entirely of balsa (with a covering of tissue paper for strength), the only exception being the engine mounting, made of plywood. Aluminium foil strips were added to assist in the radar tracking. The tail plane was mounted independently of the rudder unit.

The weight of the model was 934 grammes (about 33oz). The plane carried 156 grammes (5½oz) of fuel, giving it an all-up weight of 1,090 grammes. Wing loading per square decimetre was 20.75 grammes.

The motor, a diesel, was a Japanese Enya 15D, with a stroke of 14.99mm, a bore of 14.22mm, giving a cylinder capacity of 2.48 cubic centimetres. A radial mount plate was fitted to give a good aerodynamic effect and to assist in keeping the fuel warm at high altitude through a circulation of air from the motor.

Fuel, carried in three tanks (two in the wings feeding by gravity to one in the body), was 50 per cent kerosene, 20 per cent oil (SA40) and 30 per cent ether, to which was added two per cent of amylnitrate.

Preparations for the flight were made 24 hours in advance when generally favourable meteorological conditions were indicated.

The first attempt, made at 3.30 p.m., was a failure. The motor died within a few minutes, and the model was recovered undamaged.

It was well after 4.30 p.m. by the time all was ready for the final launching. The mixture had been too lean on the initial flight.

This time the plane climbed quickly.

At first the ascent was very steep as the plane, launched into the wind, breasted the airstream. As altitude increased, the strength of the airstream began to carry the plane northward, and after a few minutes it could no longer be seen by the group on the airfield.

RADAR TRACKING

But the radar unit had it in its beam. Quick computations were made as the model, now flying in a south-westerly direction at a speed of about 30 knots, was swept further and further from the take-off area.

After 27 minutes in the air, the plane was at 11,790ft. This meant that it had been rising at an average rate of 440ft a minute.

A reading just over 11 minutes later gave an altitude of 14,100ft, showing a rise of about 220ft a minute over that period.

By now the scanner was experiencing difficulty in picking up the plane.

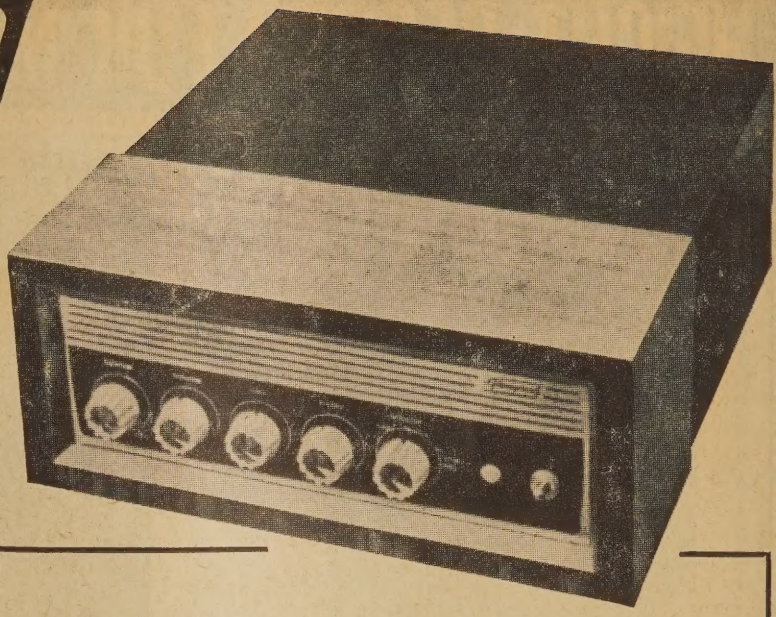
The next reading showed a rise of

(Continued on Page 47)

THE Grampian

590 SERIES

"CONVERTIBLE" HIGH FIDELITY AMPLIFIERS



The release of the new stereo recordings has meant that a new approach must be made when considering your equipment, for although stereo reproduction has many advantages it may not be convenient to instal a full system at once.

The new GRAMPIAN "590" series has been produced specially to meet this condition and enables you to commence with a "mono" or single channel system at once and convert to stereo at any time.

The basic equipment consists of a control unit which is fitted with all the necessary controls and circuitry for both "mono" and "stereo" working. It is designed for use with crystal pickups and embodies equalising circuits for 78 r.p.m. and LP recordings. Wide range tone controls are also fitted.

Directly fitted to the control unit is a power amplifier, Type 584, having a push-pull output of 7 watts R.M.S. (10 watts peak). This assembly, the 590/1, forms a complete equipment to operate from conventional single channel discs, single channel tape recorders and radio tuner units.

Conversion of the above unit to stereo is simple. It is only necessary to fit a further 584 power amplifier in the mounting already provided and connect up. No alterations to, or extra parts are required for, the control section, and the unit will then operate as a stereo system with an output of 7 watts on each channel or as a single channel system with an output of 14 watts with two loudspeakers. The differential gain (balance) control for the accurate adjustment of stereo reproduction by matching the input signals from stereo discs and stereo tape recorders to the two identical power amplifiers is already provided.

It can, of course, be supplied initially in the stereo form, Type 590/2, with the two amplifiers already assembled and connected.

Both models are obtainable in chassis form for mounting into the user's own cabinet, or complete in an attractively styled wooden surround.

TECHNICAL SPECIFICATIONS	Type 590/1 Single Channel	Type 590/2 Stereo
Output power	7 watts (RMS) 10 watts (peak)	14 watts (RMS) 20 watts (peak)
Output Impedance	4 & 15 ohms	4 & 15 ohms
Input Impedance P.U.	1 Megohm	1 Megohm
Input Impedance Tuner/Tape	0.5 Megohm	0.5 Megohm
Input Sensitivity P.U.	0.5 volt	0.5 volt
Input Sensitivity Tuner/Tape	1 volt	1 volt
Hum and Noise	— 60 db	— 60 db
Distortion at full output	Less than 1% at 1 K/c	Less than 1% at 1 K/c

Controls:
Balance plus minus 4 db on each amplifier, total 8 db
Bass plus minus 8 db at 40 c/s
Treble plus minus 10 db at 15 K/cs
Selector Tuner, 78, LP, Stereo disc, Stereo tape.

Ask our distributors for a demonstration and full technical data.

Australian National Distributors:

Simon Gray Pty. Ltd.

28 Elizabeth St., Melbourne. Phones: MF 8211, 8166.

NEW RADIATION RESEARCH PLAN

CAN TEST MACHINES IN OPERATION

The top priority accorded to all forms of nuclear radiation is shown by the new facilities and laboratories which are being opened up in all parts of the world. So fundamental are their results that the world of wonders being opened up could change living patterns for all mankind.

EXTENDING in scope from earth to outer space, its studies are expected to be the most thorough ever undertaken to explore the effects of nuclear energy upon man's physical environment.

Working with nuclear radiations that travel at speeds near that of light itself —that can "see" through concrete and turn wood into edible cellulose—engineers and scientists will help spur the pursuit for practical knowledge and use of the most awesome forces in creation.

By trying to duplicate radiation in outer space, the laboratory will seek—among other things—an answer to how space vehicles and their occupants may be protected from cosmic bombardment.

Begun five years ago by the laboratory, the radiation chambers represent an investment of some 1,500,000 dollars in buildings and equipment.

In many cases, complete equipment, such as motors and transformers, will be radiation-tested while in actual operation. This is in contrast to conventional procedure in which machines and other equipment are generally tested piece by piece.

Nuclear particles that promise new wonders affecting nearly all phases of human life—from helping point the way to reclamation of desert wastelands to ultra-fine measurement beyond the reach of the analytical chemist—will be put to work in three basic operations.

Machinery and other equipment up to about the size of a telephone booth will be studied in a radio-active-cobalt chamber. Inside the sealed "hot room," 10,000 curies of "Cobalt 60" are contained in a metal basket beneath 16 feet of super-purified water. It is expected this will be increased to 15,000 curies by mid-year.

By a system of controls located outside the 4½ft-thick walls of the sealed chamber, the basket is drawn slowly to the top of the well for radiation. Instruments placed both inside the 22-by-12-by-10 foot room and at the remote control panel outside keep a constant check on what is happening at every phase of operation. Visual observation is provided through a water-filled window installed in the thick concrete wall, and by means of closed circuit television.

There is at present very little information on how equipment will operate under moderate or low radiation doses over long periods of time. Gamma rays emitted by the radio-active cobalt will be trained upon objects for periods of months or if need be years.

Radio-active cobalt is manoeuvred into place at the bottom of a 24ft well at the GE Company. When raised above the protective shield of water the cobalt 60 gives off gamma rays that penetrate every corner of the room. The cobalt source will be used in a new, long-term program for exploring the effects of nuclear energy on man's technological environment.

So far as is known, the cobalt room is the largest yet constructed for this type of investigation. Normally, objects to be studied are placed into a narrow cylinder containing the radio-active substance. This severely limits the size of the object to be radiated—making it necessary to run the test part by part, and providing no opportunity to observe and instrument the object while under radiation.

In the cobalt chamber, entire machines will be radiation-tested under nuclear bombardment up to 500,000 "roentgens" an hour. About .007 roentgens per hour is the most a human being can take. The dose rate falls off to about 2,000 roentgens an hour in a far corner of the chamber.

Elaborate safety precautions include the 16-foot depth of water shielding the radio-active cobalt when anyone is inside the room. The radio-activity does not remain in the chamber when the cobalt has been withdrawn again into the well.

The new facilities also include two 15-foot high "accelerators" or "atom smashers" in which electrical particles are given the violent boosts in speed that are required to produce neutron and electron bombardment.

Each accelerator generates one million electron volts—low penetration electrons in one case and high penetration neutrons in the other.

Early investigations with "artificial lighting"—a prelude to some of today's nuclear acceleration work—were pioneered by Charles Proteus Steinmetz, one of the founders of the General Electric Laboratory.

ORYX

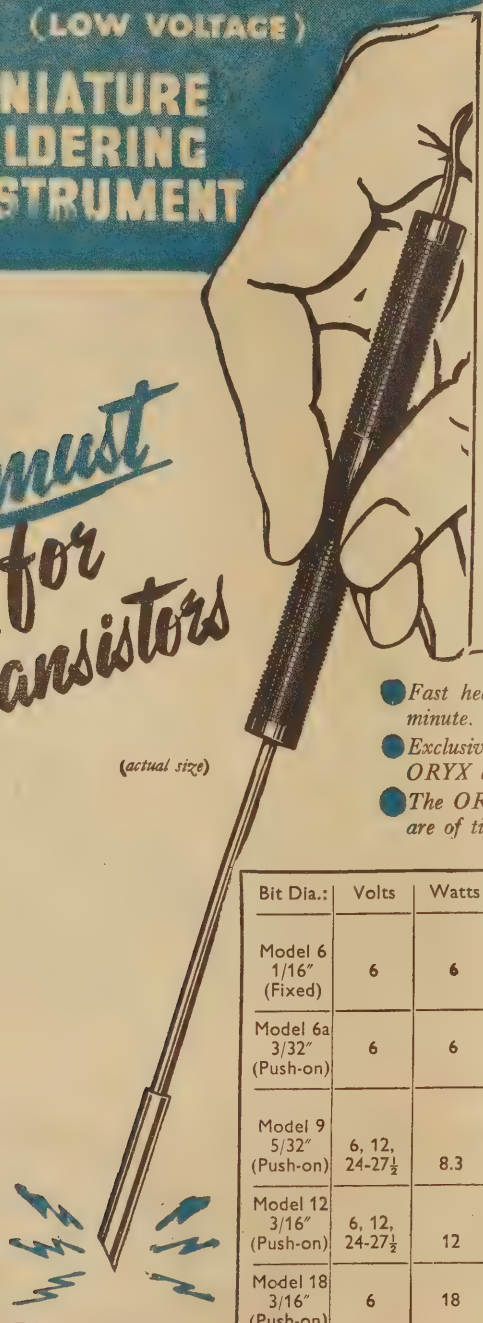
(LOW VOLTAGE)

MINIATURE SOLDERING INSTRUMENT

PROTECT YOUR TRANSISTORS WITH ORYX

There is a danger of damage when soldering to transistor leads, due to A.C. leakage currents. The use of a low-voltage transformer supply, with earthed secondary is therefore recommended. Take care also that too much heat is not applied to flying leads. The ORYX iron, and a heat-sink such as heavy pliers gripping the lead between the contact point and the transistor, will ensure protection.

A must for Transistors



(*actual size*)

- *Fast heating element, ready for operation in less than one minute.*
- *Exclusive design features resulting in universal acceptance of ORYX as the standard miniature soldering instrument.*
- *The ORYX long life element will outlast several bits which are of tight push-on fit.*

Bit Dia.:	Volts	Watts	Nett Weight	Length	Recommended Use
Model 6 1/16″ (Fixed)	6	6	0.25 oz.	6″	Electrical measuring instrument fine assemblies, hairsprings, R.F. pick-up and speech coils, hearing aid sub-assemblies, etc.
Model 6a 3/32″ (Push-on)	6	6	0.25 oz.	6″	As for Model 6 (for extremely delicate work only).
Model 9 5/32″ (Push-on)	6, 12, 24-27½	8.3	0.25 oz.	6″	Hearing Aids, Radio and TV Sub-assemblies, Coils, Electronic Instruments, Model Construction, Electro-Medical, etc.
Model 12 3/16″ (Push-on)	6, 12, 24-27½	12	0.5 oz.	6.25″	Radio, Television, and Telecommunications assemblies.
Model 18 3/16″ (Push-on)	6	18	0.75 oz.	7¼″	For heavier work, heat capacity equivalent to that of most 80 watt soldering irons.

Australian Distributors:

MANUFACTURERS SPECIAL PRODUCTS PTY. LTD.

47 YORK STREET, SYDNEY

MELBOURNE : Amalgamated Wireless (Australasia) Ltd. ADELAIDE : Newton McLaren Ltd.
PERTH : Nicholsons Ltd., Carlisle & Co. Ltd. HOBART : Noyes Bros. Ltd. BRISBANE : Chandlers Ltd.

MSP3.58

NEW THERMIONIC HEAT CONVERTER

PRODUCES ELECTRIC POWER DIRECT FROM HEAT

The advantages of a device to convert heat directly into electrical power are so great that intensive research continues to produce practical devices. So far most of these have only modest capabilities.

A WORKING model of a thermionic converter — a device that produces electricity directly from heat—was described by General Electric Research at a meeting of the American Physical Society at Cornell University.

The new device, a combination of metal and ceramic discs surrounding a high vacuum, is the size of a small coin, and produces electricity when the flame of a blowtorch is played upon it. The new converter, with its high vacuum, is in contrast to early models, which were filled with gas.

Possible applications may be found wherever a high temperature source of heat is available and a supply of electricity is needed. Any source of heat, nuclear or conventional, can be used. The converter, as a result, should prove valuable in a wide variety of applications, including aircraft, missiles, and satellites. It is estimated that converters the size of those discussed will be made capable of operating in the one to ten-watt range.

VALVE TECHNIQUES

The new converter is constructed by means of techniques similar to those used for high temperature electronic valves. This type of design has the advantage of operating at a lower temperature than the gas-filled converter (1,500 deg. F, v. 3,000 deg. F), which makes material requirements easier to meet.

In the thermionic converter, two electrodes are held at high, but different temperatures. Electrons are "boiled out" of the hotter cathode and are collected by the relatively cool anode. They can then flow through an external circuit and do work.

The original announcement of the converter referred to "new approaches" to the gas environment within the foot-long glass tube. The gas involved is cesium vapour, which partially ionises, thus neutralising the space-charge effect that would otherwise block the flow of electrons from cathode to anode.

Equally important, is the fact that the cesium coats the electrodes, thus affecting their work functions (the amount of energy that must be used in order to free an electron from the electrode and release it into the surrounding space). The difference between the work functions of the cathode and the anode is the key to the successful operation of the thermionic converter since this difference provides the voltage that drives electrons through the circuit.

One of the new thermionic converters for which a bright future is forecast.

The problem of reducing the internal resistance of the converter can be approached in several ways. One is by using a partly ionised gas. A second is by placing the electrodes extremely close together, which is the method used in the new high vacuum converter.

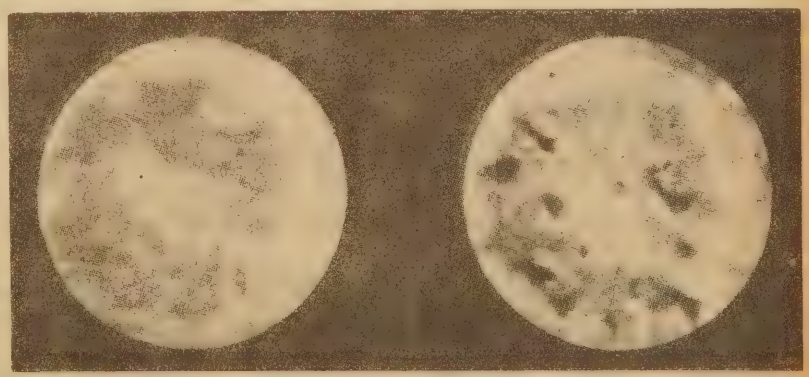
The efficiencies of all types of thermionic converters could reach 30 per cent or better, depending upon the details of particular designs. Efficiencies obtained with the high vacuum converter are still low, but further development of the design is expected to greatly improve its performance. Present efficiency of the gas-filled converter is slightly over 8 per cent.

NEW ULTRA-VIOLET IMAGE CONVERTER TUBE

INVISIBLE ultra-violet images of specimens are converted into visible pictures by a new tube called the Ultrascope. Developed by R.C.A., the new tube is intended to replace the regular eyepiece of a microscope adapted for ultra-violet viewing.

The ultra-violet accessory viewer consists of two units—the Ultrascope and eyepiece and a compact power supply. Invisible rays from an ultra-violet lamp pass through the specimen under observation and through an ultra-violet objective lens. On the faceplate of the image-converter tube an invisible ultra-violet image of the specimen is formed. The faceplate transmits ultra-violet rays.

On the inner surface of the faceplate a photosensitive material converts the ultra-violet image into a corresponding pattern of electrons. The pattern is focused on the fluorescent viewing screen at the opposite end of the tube. The image of the specimen is observed on the viewing screen through a lens of the desired magnification.



Left photomicrograph shows unstained section of human brain as seen in visible white light. At right, the same specimen is shown as viewed in ultraviolet light with aid of new tube. Irregular black spots are nerve cells.

Look and look again

. . . what other
top-brand tape recorder
offers so much at this price?

PHILIPS

high-fidelity, push-button, 3-speed model ER1500

Up to six hours' recording time • Programme indicator locates passages • Safety lock prevents accidental erasure • Auxiliary panel for independent speaker, etc. • High quality moving coil microphone • Fully shaded tone control

£166/-/-

If you're looking for the latest tape recorder refinements at a reasonable cost, you needn't look any further than the Philips ER1500. It gives you the high fidelity reproduction you demand for music. It makes it easy for you to make sound tracks for your own movies. And wherever you might travel, the compact, portable Philips ER1500 will faithfully record the sounds of new and exciting places.

GET ACQUAINTED WITH THIS OUTSTANDING RECORDER AT YOUR NEAREST PHILIPS RETAILER.

For superior recording characteristics with "Full Dynamic" range use Philips Magnetic Tape.

PHILIPS ELECTRICAL INDUSTRIES PTY. LTD.

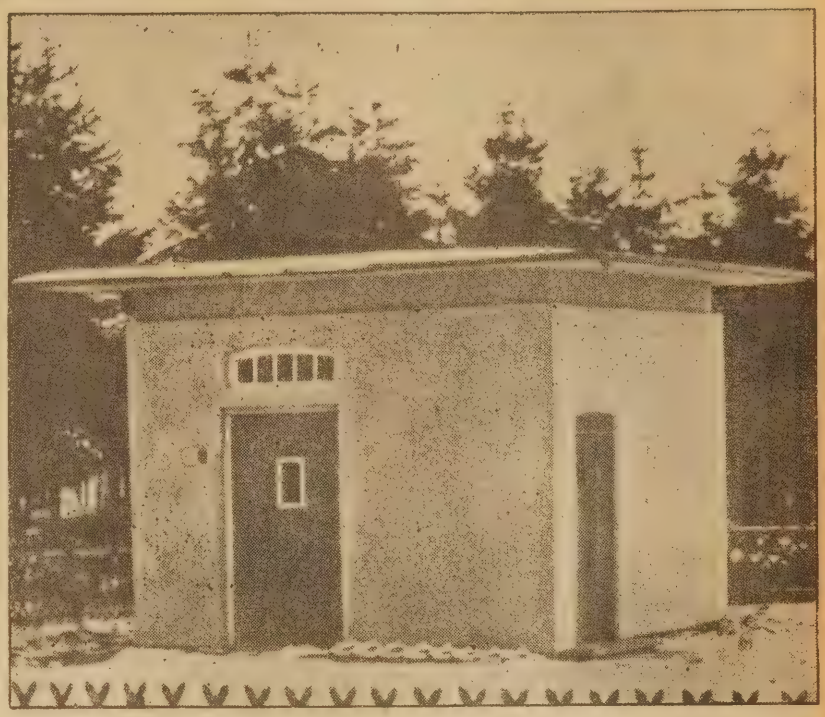
SYDNEY • MELBOURNE • BRISBANE • ADELAIDE • PERTH • HOBART

P 1345.59

THE SYDNEY-MELBOURNE TV LINK

UNDERGROUND COAXIAL CABLES WILL CARRY MULTIPLE CHANNELS

The £1,200,000 contract for the coaxial cable equipment for the Sydney-Melbourne six-tube coaxial system, which has been awarded to the Telecommunication Co. of Australia Pty. Ltd., is part of a huge program of expansion of Australian trunk telephone routes, using coaxial cable and wide-band radio systems.



An unattended repeater station of the type to be used for the Sydney-Melbourne coaxial cable link. The P.M.G.'s Department is erecting about 100 of these stations along the 560-mile route.

THESE long-distance links will not only carry hundreds of telephone and telegraph messages simultaneously, but will also relay TV and radio programs.

The value of the Sydney-Melbourne cable and associated electronic equipment on order is £3,040,000. The tender of Felten and Guilleaume Carlswerk AG, of West Germany, has been accepted for the supply of the coaxial cable.

Cable for the first section of the route between Sydney and Canberra will be supplied from West Germany, while the remaining 70 per cent will be made in Australia by Olympic Cables Pty. Ltd., Footscray (Vic.).

The Sydney-Canberra section should be in operation by June, 1961, and the first circuits between Sydney and Melbourne by January, 1962.

The electronic equipment will allow the Post Office to cram about 1,500 telephone trunk lines and at least one TV channel into the cable, which is only 1½in in diameter.

The telephone and TV links will be interchangeable, so that if the telephone link should fail for any reason, the TV link could be used immediately to replace it without interruption to the telephone service.

The system also incorporates automatic wiring devices, duplications and safety measures, which will eliminate delays caused by power failures, damage to the cable, or breakdowns in equipment.

There will be 100 unattended repeater stations along the 560-mile route.

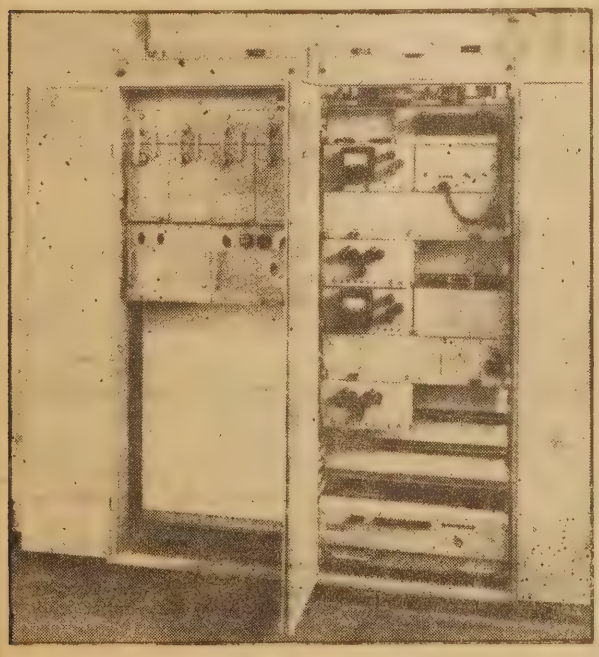
The power required to operate them will be drawn from the public electricity supply at the terminal stations at Sydney and Melbourne and the 13 intermediate (attended) stations at main towns along the route.

Should this supply fail at any point or time, an emergency engine alternator will start up automatically in a few seconds.

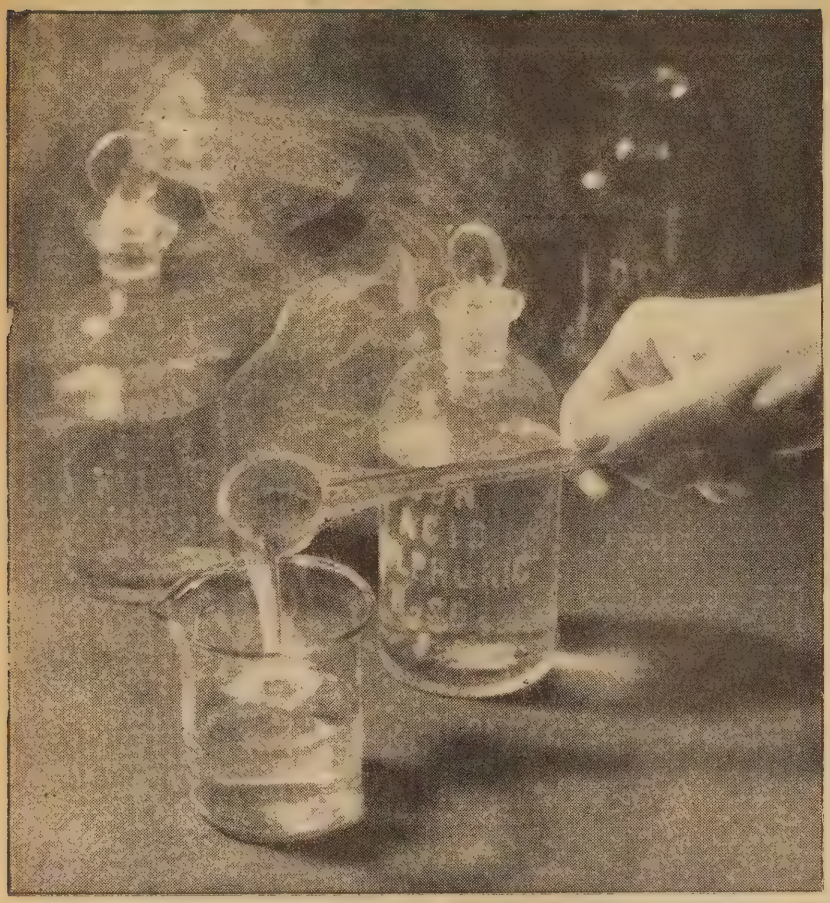
The cable will have gas continually pumped through it at low pressure. If any damage should occur, the gas will leak at the damaged point, causing a reduction in pressure, and special pressure detectors will immediately ring an alarm at the nearest attended intermediate station. This will not only warn the technicians there, but will also indicate the whereabouts of the damage.

All operating troubles occurring in unattended repeater stations are signalled to the nearest attended station over a pair of wires or a phantom circuit of one of the quads in the interstices of the coaxial cable. The equipment permits the signalling from one unattended station of up to 19 different faults, including tube failure, drops in level, or complete failure of the pilot frequency system, failure of the power feeding equipment, unauthorised entry into the station, fire, etc.

The terminal and intermediate (attended) stations through which the cable will pass are:—Sydney, Campbelltown, Bowral, Goulburn, Canberra, Yass, Gundagai, Wagga, Henty, Albury, Wangaratta, Benalla, Euroa, Seymour, and Melbourne.



The equipment contained in an unattended repeater station. The left bay contains the power supply.



An almost indestructible plastic made from Saran here shows its usefulness as a container for potent acids.

Science of Chemurgy Reclaims Waste

Some of our most valuable manufacturing materials have been reclaimed by the chemist from waste products provided by other processes. Others have been produced from the most unlikely sources and have created new industries to process them.

by Calvin Walters

CHEMURGY can be described as the science which devotes its energies to the industrial utilisation of agricultural products and wastes.

The farmer is concerned mainly with growing crops for food. He is not very much concerned as to what can be done with the waste products of his farm such as corn cobs, oat husks and so on except that if somebody can make use of them and buy them from him so much the better for his income.

The chemists and allied sciences, however, are very much concerned with the waste farm products and the result has been the production of an endless variety of chemicals, plastics, oils, paper and so forth.

Every time you crack a walnut, pull out a weed or plant, trim the hedge or mow the lawn you handle material which has had a tremendous impact on industry since Word War I. For every plant which springs through the ground contains something which can be put to use in industry in some way.

Most people think of the wealth of a country in terms of food production, minerals or oil. It is true that there is enormous wealth in the earth in the form of minerals but these are not replaceable. There is no evidence that new mineral deposits or oil deposits are being created.

The vegetable kingdom, however, is forever replaceable and therefore represents an endless source of supply of whatever can be extracted from it.

Those industries therefore which rely on agriculture for raw materials have a never-ending source of supply right on their front doors so to speak.

Before we go further into the matter of the industrial usage of plants it may be as well to see just what is required to grow them.

Most of us would say that a plant contains water, minerals and wood.

NOT TRUE OF MINERALS

To some extent this is true, but not of the minerals. These constitute only about 2 per cent of the content of the plant which it extracts from the soil. The other 98 per cent of the content of a plant is a product of atmosphere and moisture which is converted into solid substance by the mysterious power of the sun.

Thus atmosphere and water are the primary products from which the farmer produces his crops. As these products are inexhaustible and the most prolific within the reach of human beings, it follows that industry has an inexhaustible supply of raw materials available.

Some farmers may not altogether agree that moisture is always available, but in the main he comes through all right. With the constant improvement in water conservation methods the fear of water shortage is diminishing from year to year.

During growth the plant is transformed into a detailed arrangement of atoms and molecules. For instance, cellulose, which is the most prolific constituent of any plant, is found in its purest form in a head of cotton. Here nature has arranged the atoms and molecules in such a way that pure cellulose is the result.

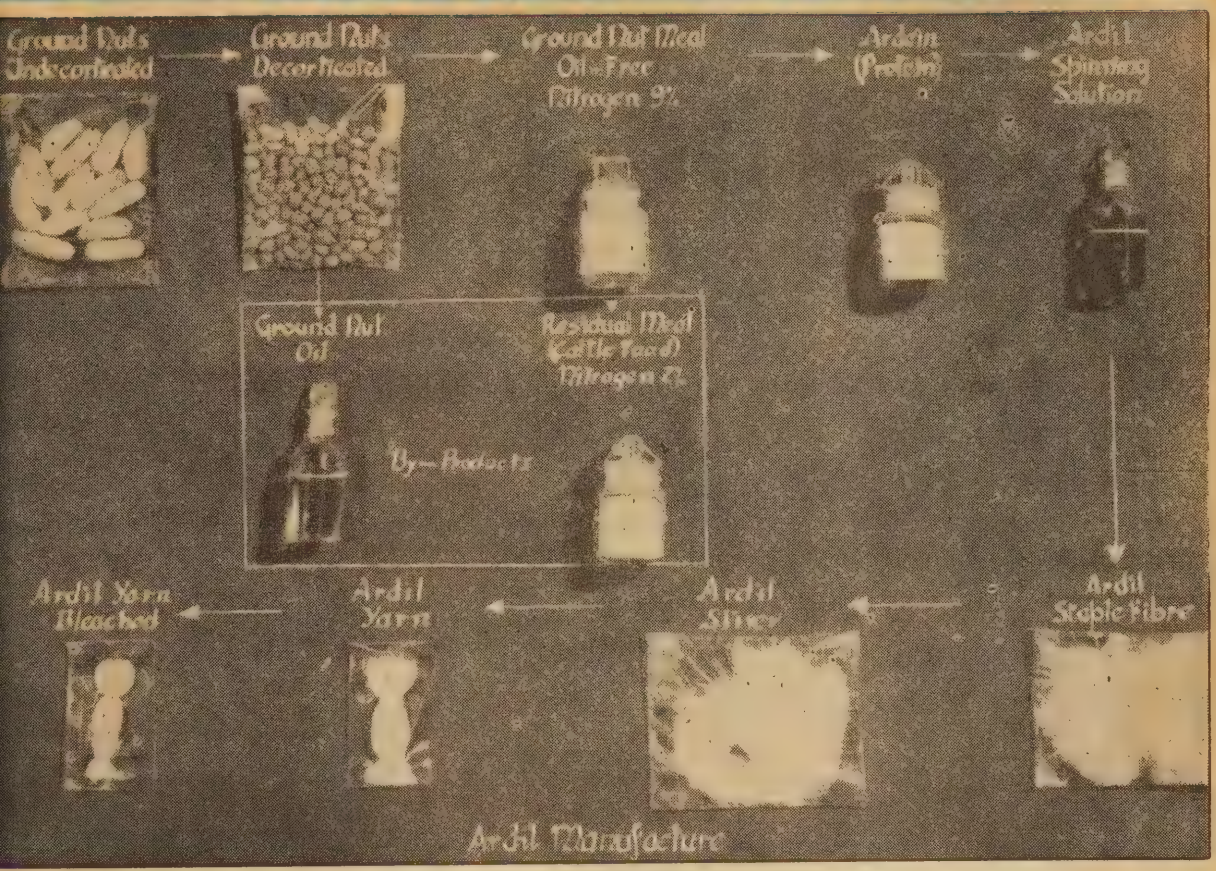
On the other hand the atoms and molecules of the cotton seed are arranged so that it contains about 20 per cent oil.

Now the business of chemurgy is to rearrange the atoms and molecules so that something else happens and a new product is formed.

Thus if the cotton seed oil is subjected to a critical degree of heat under a critical pressure and in the presence of nickel dust, an atom of hydrogen attaches itself to the oil molecule.

This results in the oil being no longer a liquid. It is transformed into a solid fat which not only has better cooking

PROGRESS STORY — CONVERTING NUTS TO FIBRE



A flow-sheet which traces the original Ground Nuts, or Monkey nuts, to their emergence as Ardil Staple fibre.

properties but keeps better than the usual cooking fats, such as lard. Solid fats are now an established product on the world markets.

Probably the most dramatic scientific advance of recent times which has captured the imagination of the public is the discovery of plastics. Yet the first plastic was made in 1869.

In that year a chappie named Hyatt, in New York, took some wood waste, cotton fibres, nitric acid and camphor. He mixed these together and discovered celluloid. There is no need to enlarge very much on the uses of this material over the years.

It has been used to make spectacle frames, backs for brushes, collars, combs, ornaments and brooches. By the addition of colouring matter it was known by various trade names such as Xylonite, and so on.

Strangely enough it is a wonder that Hyatt didn't blow himself to pieces when messing about with his concoction. A little stronger nitric and sulphuric acid and a slight change in the manufacturing method produces a high explosive known as gun-cotton.

Although celluloid is still extensively used it has been largely replaced by cellulose acetate. This is produced by treating wood pulp and cotton with acetic acid and other chemicals. Cellulose acetate is not inflammable like celluloid. It was first made in 1927.

The hull of an oat is probably one of the most tasteless things in existence. Not only is it tasteless but it has a habit of sticking in the throat. That is probably why it is not popular as a food. It is even worse in the latter respect than the pies dished up in some cafes.

To the factories which produced oatmeal breakfast foods the hulls were a darned nuisance. They could only burn them in the furnace. As the hulls accounted for about 30 per cent of the weight of the oat they took up a lot of room in the oatmeal factory.

Chemists were brought on the job to see if anything could be made from the oat hulls. They found that the hulls contained a substance known as pentosan.

CONTAIN PENTOSAN

This is a substance which can be decomposed into various forms of sugar.

Now it was known that corn cobs also contained pentosan, and that a chemical called furfural could be made from corn cobs. No one knew what furfural could be used for, but if it could be made also from oat hulls, then at least a use was found for those pesky things. The future would no doubt find a use for furfural.

So the chemist found that he could make furfural from oat hulls. This was in 1922, but not much use was found for the chemical. Then, about 10 years later, petroleum chemists found that furfural dissolved out the objectionable gums in lubricating oil. The demand for oat hull increased considerably. Its chemical, furfural, is responsible for one of the most dramatic improvements in lubricating oils.

Then the manufacturers of grinding wheels found that furfural combined with certain resins made an excellent bonding material for cementing together the tiny abrasive particles from which the wheels are made.

Combined with phenol, furfural makes a plastic for the manufacture of steering wheels, helmets and other articles.

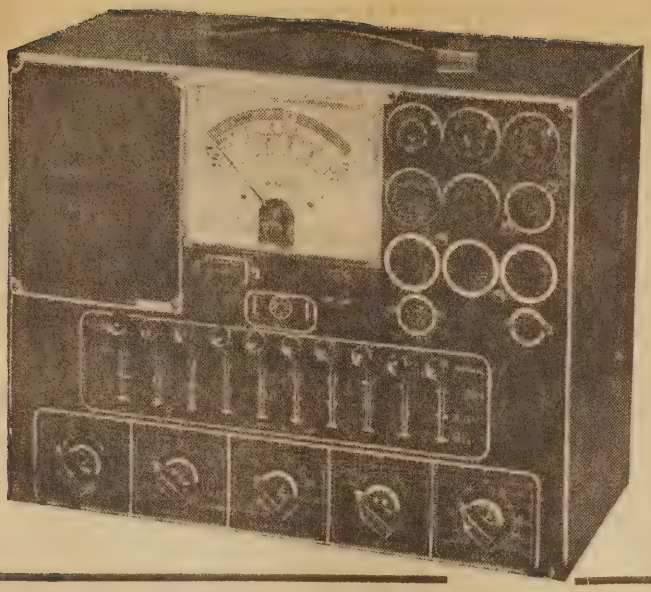
Furfural was extensively used during the war for facilitating the manufacture of synthetic rubber.

To give some idea of how a chemist goes about the extraction of his chemical from waste material we will give a brief outline of the manufacture of furfural.

The oat hulls are first ground and then digested with weak sulphuric acid at a temperature of 153 degrees centigrade under a steam pressure of 60 pounds per square inch.

Whilst being mechanically stirred in the digester the steam is drawn into a vertical copper tube which is provided with a series of plates. These are positioned so that, as the steam condenses, it is "fractioned" into water and furfural, which are drawn off separately.

Thus it was that a previously worthless waste product has been converted into a valuable by-product for the farmer by means of chemurgy.



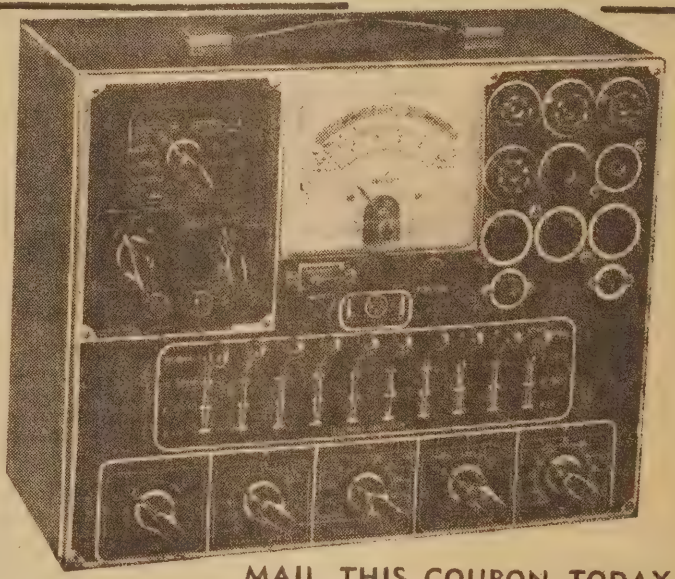
VALVE TESTER MODEL TVT.

This is the latest in valve testers and is flexible over a very wide range allowing all types of tubes to be tested irrespective of their pin connections. Individual lever switches are used for every pin, and a range of twenty filament voltages allow all types of tubes to be tested quickly and accurately. It is designed for ordinary radio use as well as for testing TV tubes, and can be used as a portable instrument or bench instrument.

TWO FAMOUS UNIVERSITY
RADIO/T.V. TEST INSTRUMENTS

VALVE AND CIRCUIT TESTER MODEL TST/2

The Model TST needs no introduction to the radio and TV service industry in Australia, and Model TST/2 is built on the same basic principles of good quality and lasting service, but with improvements to allow testing of TV tubes and to give it a more flexible range than TST. As well as having all the features of Model TVT valve tester, it allows AC/DC and output voltages to be checked up to 1,000 volts together with a range of D.C. current up to 250 milliamperes and self-contained resistance ranges up to 10 megohm. Designed to operate from A.C. it is supplied with instruction booklet and test leads.



UNIVERSITY GRAHAM INSTRUMENTS PTY. LTD.

5 NORTH YORK ST.,
SYDNEY. BU3169.

MAIL THIS COUPON TODAY!

MAIL THIS COUPON TO:
UNIVERSITY GRAHAM INSTRUMENTS PTY. LTD.
5 North York Street, Sydney. 'Phone BU3169.

Please send me details of .....

NAME .....

ADDRESS .....

.....

A use has been found for corn cobs. If these are ground so that they will be retained on a wire screen of 32 mesh, they make a remarkably efficient material for removing organic matter and other deposits of oil, rust, dust or carbon from machines, bearings and other surfaces which must not be injured.

The cob dust is used by blowing through sand blasting machines, and this is now standard practice in the United States Navy.

Ground corn cobs are also used for mixing with clay to make tiles of extreme lightness.

The cobs are mixed with the clay, and, after burning in the kiln, the cobs burn away cleanly, thus leaving air spaces in their place. Cob dust is also used for metal burnishing and cleaning furs.

Chemurgy has done wonderful things with the soy bean. This bean is perhaps better known to the public as one from which a flour is made for bread manufacture. It has become popular for its high protein content, and is used extensively by those who pay particular attention to their waist line.

In the industrial field the soy bean is one of the most versatile farm products of all time. From it is made food, wallpaper, flyspray, linoleum, explosives, paint, soap and car parts.

The foam extinguisher used on oil and electrical fires is derived from soy beans.

Soy bean oil is a valuable by-product of the bean. It is mainly used for cooking purposes, but by solidifying it in a manner similar to that used for cotton seed oil, it is used as an ingredient of margarine or a shortening for pastry.

DISTILLATION

To separate the different constituents of soy bean oil, the fractional distillation method as used in the refining of petrol.

The first product is glycerin and fatty acids. The latter are then passed through the fractionating process to emerge in various forms.

One fraction is used for the making of soap, rubber and cosmetics. Another is a high grade drying oil used in paint, lacquer, varnish and other coatings.

Soy bean oil is used for the manufacture of alkyd resins used in paint-making. Paints made from these soy bean oil resins are superior to others in their resistance to deterioration by sunlight.

Fire fighting foam is made from a protein called alpha protein. This is a pure protein derived from soy beans. Forced through a special nozzle at a pressure of 125 pounds per square inch, a mixture of 94 per cent water and 6 per cent protein compound covers the fire with an oxygen excluding blanket, thereby extinguishing the fire.

Strangely enough another product of the soy bean known as lecithin is an anti-foaming agent. It is used in processes where foaming of liquids interferes with the manufacturing process. It is apparently not used by breweries.

Lecithin was previously derived from egg yolks. There were not enough chooks to supply the demand, so that it was made in only small quantities. The discovery that it could be made from soy beans gave it a wider application, for now it could be made in unlimited quantities. You can get more beans from the soy plant than googs from a chook.

Lecithin is now used in such versatile ways as a stabiliser for ethyl petrol, as an aid to the emulsification of oil and fat, as a wetting agent, an ingredient of chocolate, in insecticides, explosives, pottery, ice-cream, printing ink and cosmetics.

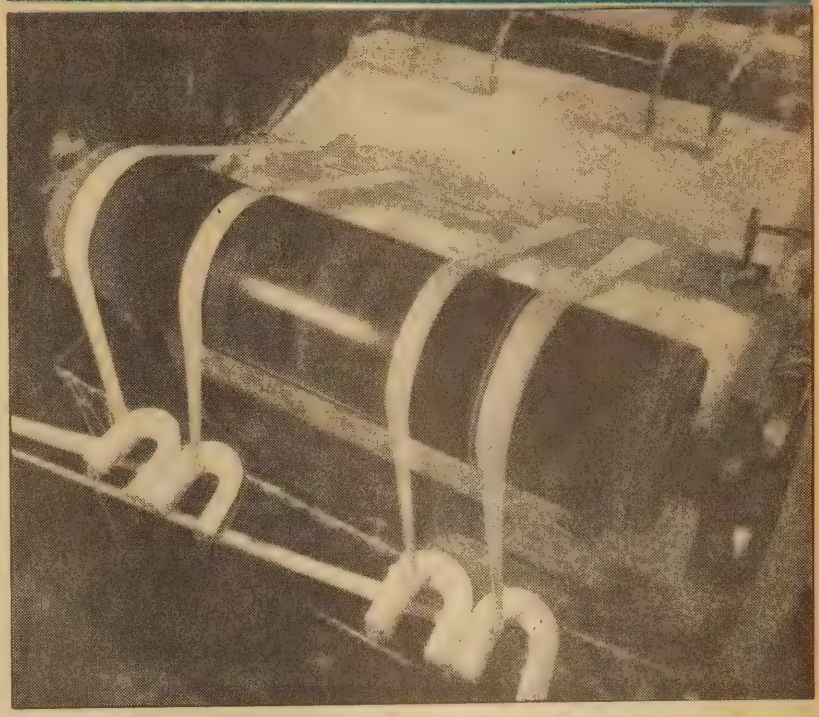
Modern waterproof plywoods and wallpapers are made from a glue derived from soy beans.

What has been described as a threat to wool is a fibre made from soy bean protein. The main reason why wool is so much better than other fibres for the manufacture of cloth is that it has a crimp, which makes the cloth elastic and long-lasting.

No one had come up with an artificial fibre with a crimp.

Now the soy bean protein artificial fibre shows signs of being a competitor with wool.

SPINNING THREAD FROM MILK



Aralac fibre is made from milk, It is shown emerging as four tape-like strips from four spinnerets in the foamy mass of the processed milk.

THROUGH SPINNERETS

The sticky protein extracted from the soy bean is treated with various chemicals and passed through spinnerets to emerge as a fibre which is soft and fluffy, has a warm feel and a natural crimp. It is either a light tan or white, and very elastic. It is almost three-quarters as strong as wool. It is at present being mixed about fifty-fifty with wool to make fabrics for upholstery and blankets. Work is still progressing with this interesting fibre.

Whilst nature has provided the soy bean with such as astounding variety of possible by-products, chemurgy chemists and engineers had to do considerable research for a number of years before these by-products became available. The various fractions of the soy bean are not easily wrested from it, but simplification of the various processes is going on so that the soy bean is rapidly becoming an economic necessity.

Who would think that a walnut shell is of any value? Yet this lowly substance is now being used in large quantities in various industrial processes.

There are two important ingredients in walnut shells, named lignin and cutin.

The shell contains about 31 per cent lignin and 5 per cent cutin. Now lignin is also important to the plant in that it is used to bind the small cellulose fibres together.

USED IN PLASTICS

This latter fact, in this age of plastics, engaged the attention of the chemurgy chemists with the result that lignin is now used for making plastic sheets for trays and table tops, firemen's helmets, impregnating solutions to bind fibrous material into laminated sheets for building purposes and so on.

When wood, which has been pulped up and chemically treated for paper-making is filtered from the chemical liquor, the latter can be treated with lime which separates lignin from the solution. By treating this further with acid it is converted into a sulphite lignin base. If this is now treated further in a certain way, we get vanillin, which is an artificial vanilla flavouring much stronger than natural vanilla, and now used almost exclusively in all processes calling for a vanilla flavouring.

If the above-mentioned sulphite lignin

(Continued on Page 119)

MAGNETIC SOUND INDUSTRIES

TAPE RECORDERS from £65 or £8/10/- deposit

We are the only Grundig Tape Recorder Specialist in Sydney, stocking all spare parts, and offering a specialised repair service under the direction of trained Grundig engineers.

Top trade-in prices are offered on all Grundig Equipment

We have in stock the latest 1959 Grundig TK 20, Twin Track model with $3\frac{3}{4}$ speed and a frequency response of 50-10,000 cycles.
This machine records for three hours and is complete with the highest-grade condenser microphone.
Price £139/10/-, or £14/10/- deposit.
Also the Grundig TK 35, an entirely new Grundig Tape Recorder with Twin Track and three speeds, $7\frac{1}{2}$ per second, $3\frac{3}{4}$ and $1\frac{7}{8}$.
Frequency range is 50-18,000 cycles at $7\frac{1}{2}$ which makes it the world's finest tape recorder.
Special features include: Temporary Stop, Superimposition (erase cut-out button), Automatic Stop Switch, Special Loud Speaker.
Price £210/-/-, or £22/-/- deposit, complete with tape and super-grade condenser microphone.

Magnetic Sound Industries *Sydney's only tape recorder specialist*

387 George St., Bisley House (two doors from Kodak) BX 4440 BX 4587

Technical Review

LOADING FOR THE PIEZOELECTRIC CARTRIDGE

Optimum performance from ceramic or crystal phono pickups may be obtained when they are matched to the amplifier input correctly. Here are the reasons, and some of the cures.

THE Piezoelectric phono cartridge, once disdained for high fidelity service, has become a full-fledged member of the high fidelity family, particularly in view of the facility with which it lends itself to stereo design. However, its suitability very much depends upon its being properly loaded. Essentially, the loading problem is one of maintaining proper equalisation of the RIAA recording characteristic; at the same time, output level and distortion are also at stake.

Voltage output of a piezoelectric cartridge (usually ceramic, though sometimes crystal) is proportional to recorded amplitude, rather than to velocity as in the case of a magnetic pickup. Hence the equalisation requirements differ radically from those for a magnetic cartridge. Whereas the magnetic requires bass boost and treble cut, the piezoelectric needs **bass cut** and **treble boost** in order to match the RIAA recording curve. See Fig. 1.

CIRCUIT TIME CONSTANT

To obtain bass cut that reasonably compliments the RIAA recorded **amplitude** characteristic, the total circuit capacitance—cartridge, cable and input tube—and the load resistance should have a time constant of about 1,000 to 1,300 micro-seconds.

For example, assume that a piezoelectric cartridge has 500 uuf capcitance, which is typical, and works into a typical load of 500 ohms. But in order for RC to be, say, 1,300 microseconds, total circuit capacitance should be 2,600 uuf instead of 500 uuf. Allowing 500 uuf for the cartridge and about 200 uuf more for the cable and input-tube capacitance, another 1,900 uuf is required across the cartridge in order to achieve the correct amount of bass cut; that is, to avoid too much bass cut. The equivalent circuit is shown in Fig. 2. This of course is a high-pass filter, producing a decline in response below the frequency at which total capacitive reactance equals load resistance.

ADDING RESISTANCE

Instead of adding a shunt capacitor across the cartridge, the required time constant could be obtained by adding a 1.4-megohm resistor in series, as shown in Fig. 3. However, the disadvantage of this method is that the input capacitance of the input tube and the parallel resistance of the 1.4-megohm and 500-K resistors form a low-pass filter, causing a loss in response at high frequencies. The equivalent circuit at high frequencies appears in Fig. 4. Assuming an input capacitance of 50 uuf for the input tube, a reasonable figure for a triode such as the 12AX7, response would be 3 db down at about 8,600 cps, declining thereafter at a rate approaching 6 db per octave.

Thus it is preferable to obtain the required time constant by means of a shunt capacitor. Both methods will result in signal attenuation because either a capacitive or resistive voltage divider is formed so far as signal output is concerned. Figure 3 already shows how a resistive voltage divider is formed, while Fig. 5 shows how a capacitive voltage divider results from the preferred method.

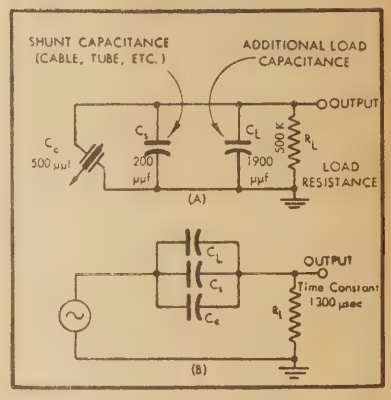


Fig. 2 (A). Loading for a piezoelectric cartridge to produce RIAA equalisation and (B) its equivalent circuit.

The loss in output voltage is in many cases a good thing, insuring that the signal is sufficiently low to prevent overloading the input tube. The writer has come across situations where cartridge signal was so great relative to the sensitivity of the control amplifier that the gain control could barely be turned up before volume became excessive. This inordinately large signal would often overload the input tube if it were located prior to the gain control. Even if the signal goes directly to the gain control, it is not a good idea to have the incoming signal so large that if someone, for example a child, were to turn the gain full on this would damage the speaker or one's eardrums or both.

Most modern control amplifiers have fairly high sensitivity on high level input. Seldom is this less than 0.5 volt and often as low as 0.1 volt input for 1-volt

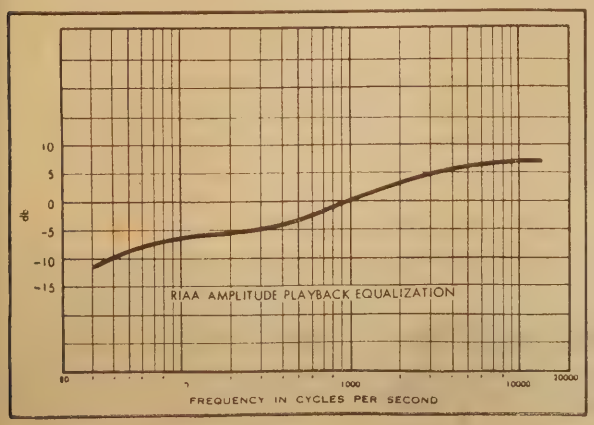


Fig. 1. The standard playback equalisation curve to obtain the standard RIAA characteristics.

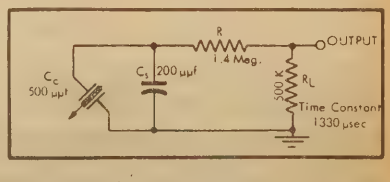


Fig. 3. Alternative means of loading a piezoelectric cartridge to produce RIAA equalisation.

TEST EQUIPMENT
FOR TELEVISION SERVICE

YOU WILL NEED THESE BASIC INSTRUMENTS!

V.T.V.M.

"METRIX" 742 ... ... £50
V.H.F. Probe £15/10/-
E.H.T. Probe £8/15/-
or "METRIX" 744 ... ... £104
E.H.T. Probe £8/15/-
or "ROHDE & SCHWARZ" ELECTRONIC MULTIMETER U.R.I. ... ... Complete, £175

OSCILLOSCOPE

"ASTOR" TV 1 ... ... £65

DC—3 Mc/s Bandwidth

Others from such famous makers as "TEKTRONIX" & "FURZEHILL LABORATORIES LTD."

V.H.F. SIGNAL GENERATOR

"METRIX" 925 5-230 Mc/s a.m. £118/10/-

926 5-230 Mc/s a.m./f.m. £140

SWEEP GENERATOR

"METRIX" 210 ... ... £92/10/-

Recommended accessory —

Low-pass Filter £11

Other accessories available on request.

VALVE TESTER

"METRIX" 310 B £72/10/-
MUTUAL CONDUCTANCE TEST
WITH UNIVERSAL PIN SWITCHING

MULTIMETERS

"METRIX" 430 ... ... £32
20,000 O.P.V. A.C. & D.C.
460 ... ... £16/10/-
10,000 O.P.V. A.C. & D.C.

FIELD STRENGTH INDICATOR

ROHDE & SCHWARZ "HUZ"

an extremely useful item in difficult situations with transistorised power supply and trickle charger, £250/15/-. Leather carrying case, £8. Probe antenna for locating sources of noise, £7.

All prices plus

12½%

Sales Tax

Prices subject to change without notice.

Ring, write or call . . .

6418

ELECTRONIC INDUSTRIES IMPORTS PTY. LTD.

VIC.	N.S.W.	S.A.	Q'LAND	W.A.
139-143 Bouverie St.	121 Crown St.	90 Grote St.	376 Ann St.	68a Railway Pde.
Carlton	East Sydney	Adelaide	Brisbane	West Perth
Telephone: FJ 4161	Telephone: FL 5041	Telephone: LA 5295-6-7-8	Telephone: 2-6462	Telephone: 28-3111

output. Assume the control amplifier has ensitivity such that 0.25 volt input drives t and the power amplifier to rated out- put, anywhere from 12 to 60 watts or so. A typical piezoelectric cartridge produces s much as 2 volts on peaks. To reduce his to 0.25 volt entails a reduction of bout 18 db. Referring to Figs. 2 and , shunt capacitance of 2,100 uuf across 500-uuf cartridge reduces its signal utput 14 db by voltage divider action. his goes a long way to prevent over- riving the control amplifier.

Although the modern piezoelectric artridge can satisfactorily match the RIAA recording characteristic when pro- erly loaded, many people still have old ecords which were recorded with LP, AES, and other recording curves, and hey wish to reproduce them properly.

One way to meet this poblem is to djust for differences between the RIAA urve and other curves by means of the one controls, using one's ears to decide

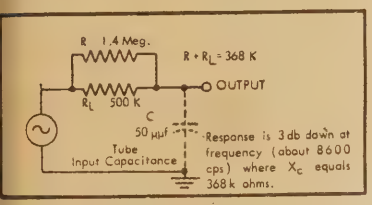


Fig. 4. Equivalent circuit of Fig. 2 at high frequencies showing how treble droop is caused.

hen tonal balance is correct. Some ersons prefer to convert the pickup into he equivalent of a velocity device inas- uch as most control amplifiers, stereo s well as monophonic, provide a variety f equalisation characteristics for velocity magnetic) pickups.

One method of converting the piezo- lectric cartridge into a velocity device is y loading it with a relatively small esistor, on the order of 47K ohms or ess. Such a resistor in series with the artridge capacitance produces a high- ass characteristic, in the same manner as llustrated at (B) in Fig. 2 in connection ith bass cut. Now, however, the very mall resistor causes high-pass action hrough all or most of the audio range, hus producing a rising response at the ate of 6 db per octave in the manner of magnetic cartridge. Then the signal an be fed into an input designated for magnetic pickup.

The above procedure contains a pitfall, nd care must be exercised to avoid it, or otherwise one will have an undesir- ble treble peak. High fidelity piezo- lectric cartridges generally have a built- n treble hump, achieved by damped esonance, which produces a satisfactory pproximation over most of the upper

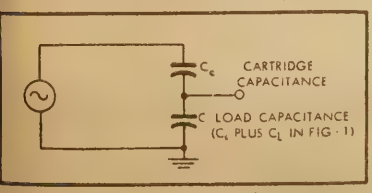


Fig. 5. Equivalent circuit showing how shunt capacitance forms part of a voltage divider to reduce signal from a piezoelectric cartridge

range of the treble boost required when reproducing an RIAA disc with an amplitude pickup (see Fig. 1).

If the pickup is used instead as a velocity device, this rising characteristic remains. However, by avoiding too small a load resistor, high-pass action can be limited in the treble range, offsetting the treble hump of the cartridge.

Manufacturers of piezoelectric pickups will generally supply users with information on the preferred load resistances for use of their product as a velocity device or as an amplitude device.

Moreover, for smoothest response, they will frequently supply users with a schematic or ready-built adapter which contains a suitable loading network to convert the pickup into a velocity device and simultaneously reduce the treble hump to an insignificant quantity.

—Herman Burstein in "Audio."

ROAD TO UNIVERSE IS OPENED

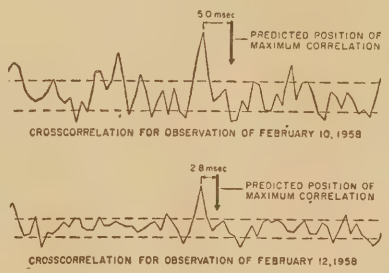
Radar contact with Venus, first achieved February 10 and again February 12, 1958, extended the range of radar to 28-million miles, more than 100 times the previous record, giving man his greatest dx. The contact gave us more accurate information on the size of the solar system, and may give us information about the surface of the planet.

THE contact was made by scientists of the Massachusetts Institute of Technology Lincoln Laboratory, using equipment never before employed for radio-astronomical purposes and introducing techniques hitherto quite foreign to radio communications.

Most conventional of the apparatus was the high-power radar at Millstone Hill, Westford, Mass. Built for special precision work, it beamed a 265kw signal in the 300-500mc range from its 84-foot parabola with extreme accuracy toward Venus.

Of all this power, only about a ¼ watt reached the planet and about a billionth of that arrived at the antenna on the return trip. The signal was so fantastically weak and buried so deep in noise no ordinary means of detection could lift it out. Two special techniques were required to recover the signal.

First step was maser amplification. The maser, first developed by Professor Townes of Columbia, adds practically no


5.0 msec
PREDICTED POSITION OF MAXIMUM CORRELATION
CROSSCORRELATION FOR OBSERVATION OF FEBRUARY 10, 1958
2.8 msec
PREDICTED POSITION OF MAXIMUM CORRELATION
CROSSCORRELATION FOR OBSERVATION OF FEBRUARY 12, 1958

The chart that showed, with less than 1 chance in 10 million of error, that a Venus contact had been made.

noise to the signal while amplifying it. A solid-state maser (using a crystal instead of Townes' gas chamber) operating at 2 degrees Kelvin (about —450 degrees F.) added as much to the received signal as would a fourfold increase in transmitter power, with ordinary amplification.

Even after maser amplification, the signal was so buried in noise that individual pulses could not be recognised. The scientists turned to the digital computer to "take over virtually all the functions usually performed by radio receiver circuits."

The signal, a train of radar pulses sent at the rate of 30 per second, was recorded for analysis by the computer. Certain pulses were deleted in a controlled but irregular manner to "code" the signal and make identification easier. To increase accuracy, a long sequence was transmitted—a series of 8,000 pulses, lasting 4½ minutes, or to within ½ minute of the time the first return pulse was expected.

The statistical method of detection used is best explained by the Lincoln Laboratory report: "The known pulse pattern of the transmitted signal was compared to the noisy and irregular fluctuations of the received signal. At each time when a pulse is expected to be present, the received signal should be a tiny bit stronger than it would be in the absence of a pulse. No single pulse makes enough impression to be measureable individually, but the total of thousands of such tiny coincidences is added (or integrated) to give a result that can be observed and measured."

MANY MONTHS WORK

Several months were required for this work. The entire 8,000-point pattern was matched some 600 times, as one pattern was shifted step by step with respect to the other. The result was the curve shown.

The by-products of this spectacular accomplishment will be as useful in astronomy, missiles and space travel as in radio and electronics. The distance of Venus has been determined within possibly 100 miles. Astronomical methods over the same distance would yield an uncertainty of about 50,000 miles. This greater exactitude will make it possible to plot courses fo. interplanetary rockets, and may stimulate the launching of one toward Venus next fall. We know also that it is possible to send and receive radio signals over interplanetary space, a necessity for space travel. We have learned something about the mysterious surface of Venus, though so far it is so combined with information on the rotation rate of the planet as to be not immediately useful.

THE WARBURTON FRANKI PAGE

BARGAINS: *Your Radio and TV needs . . . check it each month*

W-F's PRE-STOCKTAKING CLEARANCE. We are overstocked with the following lines so buy now and SAVE.

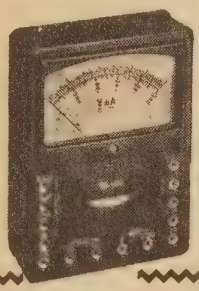
CAR AERIALS — Windscreen type complete with mounting Bridge. 3 piece **39/6.** Post. Vic. **1/8,** Int. **3/8.**
Remote Control Cables for Car Radios 36in long **39/6** pair. 12in long **27/6** pair. Post **1/6** pair.

POWER TRANSFORMERS — Horizontal Mounting 385V at 80 m.a. **35/.** 385V at 100 m.a. **39/6.** 385V at 150 m.a. **49/6.** All above with 5V and 6.3V Filament Windings.

PHONE PLUGS. P.M.G. type 1/ ea. **HEADPHONE WINDINGS** — 500 ohms **1/3 ea.**

RESISTORS—50 ohms 25 watts with adjustable tap. **2/** ea.
15,000 ohms 20 watts with adjustable tap, **2/** ea.
All above Post **3d** each.

VALVES. 1T4 or 1S5 in cartons, **8/11.** Post **6d.**



MULTIMETERS — Brand New Imported Instruments 1000 ohms per volt — complete with test leads.
Measures AC/DC Volts to 1000 in 4 ranges. DC Current to 250 ma.
Resistance to 100,000 ohms. Size—4¾in x 3½in x 1¼in.
7 gns each. Post Vic. 1/10, Int. 3/

AMPLIFIERS — Brand New Imported Mullard Type 5-10 complete with Control Box.
Type to suit Crystal Pick-up only £39/15/. Freight Forward.
* Type to suit Magnetic Pickup only £47/15/. Freight Forward.
(* Control Box contains Pre-Amplifier.)

AMPLIFIER — Brand New Imported 10 watts complete with **Pre-amplifier Control Box.** Based on the famous WILLIAMSON CIRCUIT. 50 gns. F/Fwd.

TV AERIALS — 2 Element type, ideal for primary areas — suitable for loft mounting or outside. 55/ ea. F/Fwd.

I.R.C. LOUDNESS CONTROLS ½ or 1 meg — Consists of a 2 gang Potentiometer with 2 Condensers and 1 Resistor Wired on. Less Switch 15/. With Switch. 17/6 Post 9d.

AERIAL WIRE — 100ft Coils Insulated 6/10 coil. Post Vic. 1/, Int. 2/6.

COIL FORMERS — Plastic 1¼in diameter mounted on 6 pin base. 4/2. Post 6d.

STROBOSCOPES — Metal 4 speed 4/6. Post 3d.

MAGNAVOX SPEAKERS

May be reconed easily and cheaply.
Available to order with any voice Coil Impedance

Wide Range Types

	Voice Coil ohms	Watts	Freq. Range	Price	Post	Vic.	Int.
6WR	2.7 or 15	6	30-15 K.C.S.	£6 10 0	1 10	3	0
8WR	2.7 or 15	7	30-15 K.C.S.	£7 0 0	2 3	3	8
12WR	2.7 or 15	10	30-15 K.C.S.	£7 9 7	2 11	4	4

Standard Types

	Size	Voice Coil ohms	Watts	Price	Vic.	Int.
525	5in	2.7	4	42/6	1 10	3 0
6P1	6in	2.7	6	51/5	1 10	3 0
6P2	6in	2.7	6	58/6	1 10	3 0
8P1	8in	2.7	7	52/6	2 3	3 8
8P2	8in	2.7	7	63/	2 3	3 8
10P1	10in	2.7	8	64/1	2 11	4 4
10P2	10in	2.7	8	75/6	2 11	4 4
12P1	12in	2.7	10	66/	2 11	4 4
12P2	12in	2.7	10	81/	2 11	4 4

Transformers to suit available from 500 to 14,000 ohms C.T. **30/9** each.
Post Vic. **1/10.** Int. **3/.**

PHILIPS RECORD PLAYERS & SPARES

NG1009	4-speed Player	£10 9 0	F/Fwd.
NG1010	Disc Jockey (Player in case)	£18 18 0	F/Fwd.
AG1014	Record Changer	£22 1 0	F/Fwd.
NG1012	Battery operated Player	£13 5 0	F/Fwd.
AG3016	Plug-in Heads L.P. and Std.	£1 11 6	Post 1/
AG3025	Plug-in Heads L/P. only Diamond Stylus	£5 7 6	Post 1/
AG3063	Plug-in Stereo Head	£2 7 6	Post 1/
NG1023	Counter weights to suit Players when using Stereo Head	10 6	Post 1/

4-SPEED RECORD PLAYERS in Attractive Leatherette Case, complete with Amplifier and Speaker, **26 gns.** F/Fwd.

INSULATED TERMINAL PANELS

		Post.
12in long x 1in wide. 24 Lugs each side	**5/6**	**9d.**
6in long x 1in wide. 12 Lugs each side	**2/9**	**9d.**
12in long x 2in wide. 24 Lugs each side	**5/9**	**9d.**

TAG STRIPS, 2 lug **3/6** doz., 3 lug **5/** doz., 4 lug **5/6** doz., 5 lug **6/6** doz., 6 lug **7/6** doz., 7 lug **9/** doz., 8 lug **10/** doz., 9 lug **11/** doz., 10 lug **12/** doz. Post: All **6d** doz.

32 VOLT D.C. RECORD CHANGERS.
4-speed Garrard RC88—Few available **£34/2/6** F/Fwd

THE W-F3 HI-FI AMPLIFIER — Ideal to Convert Radiograms to Stereo, or for any other purpose where a compact economical amplifier is required. **Features:** Negative Feedback Tone Control, ON-OFF Switch, Built in Speaker Transformer, **£16/19/6** F/Fwd.

CABINET OF DRAWERS — Rota Brand.
Size 17 1/8in x 6¾in x 11 7/8in. Containing 16 Drawers each 6 5/8in x 3¾in x 2 1/8in. Type CD1 Undivided Drawers **52/6**
Type CD2 3 Compartment Drawers . . . . . **60/9.** F/Fwd.

W-F FOR STEREO. Demonstrations given daily in our Hi-Fi Showroom.
Stereo Equipment available from stock includes:—
Ronette Turn-over Cartridges **92/6**
Ronette L/P./Stereo. only Cartridges **85/6**
B.S.R. TC8/S Turnover Cartridges **105/**
Acos GP73 Turnover Cartridges **115/-**
Acos GP71 L.P./Stereo only Cartridges (Diamond Stylus) **£10/17/6**
Elac Variable Reluctance LP/Stereo only (Diamond Stylus) **£19/19/**
General Electric Variable Reluctance (Diamond Stylus)
.5 tip **£26/5/**
.7 tip **£22/10/**
(All above Post 1/)

B.S.R. HF8/S Record Player **£16/16/**
B.S.R. UA8/S Record Changer **£22**
Dual 1004/S Record Changer **£37/9/6**
Collaro Conquest/s Record Changer **£17/10/**
Leak Stereo Amplifier — Twin 10 watt Channels — separate pre-amp. Control Box **£147**
Leak Stereo. Pre-amp. Control Box only **£60**
(All above Freight Forward.)

CHASSIS PUNCHES — Hammar Type Strong and Reliable
3/8in, **18/4**; ½in, **20/**; 5/8in, **20/**; ¾in, **23/4.**
(Postage **9d** each)
1in, **30/**; 1 3/16in, **33/4**; Postage **1/6.**

Write or Call for
FREE RESISTOR COLOUR CODE

EASY TERMS on items priced from 16 gns.

- **OPEN SAT. MORNINGS**
- **TRADE ALSO SUPPLIED**

- ***PLEASE ENCLOSE POSTAGE OR FREIGHT WITH ALL ORDERS***

DESIGN DETAILS FOR MODERN STEREO PICKUPS

The design of a stereo pickup poses some quite difficult problems, and there are many and varied answers, ranging from comparatively simple crystal types to ambitious moving coils. Here are discussed three standard types sponsored by well known makers in America and described recently before the Audio Engineering Society.

THE magnetic cartridge shown in Fig. 1, consists of the stylus assembly and magnet common to both channels with a pole piece and coil for each channel. Lower parts of the pole pieces incline towards each other. With the armature, they form the air gap.

When the armature is in a quiescent position resting in an unmodulated groove, flux from the magnet is distributed equally between both pole pieces. Flux flows from the magnet, along the armature up each pole piece and then back to the magnet. When the armature is moved by one groove wall being modulated at 45 deg, the armature approaches and recedes from one pole piece alternately, and remains at about a constant distance from the other. A flux change is induced in the first pole piece giving an output in its associated coil. Constant flux is maintained in the second pole piece. When the opposite groove wall is modulated, output occurs in the second coil in a similar manner. The arrangement gives good and consistent separation between channels.

CERAMIC PICKUP

One of the generators in a ceramic pickup is shown in Fig. 2 in a 45 deg. plane. It is a hill and dale reproducer. Vertical motion of the stylus is stepped down and rotated to horizontal motion of the drive point. This action gives a bending moment to the ceramic element. A soft rubber block under the element balances the biasing force on the drive point caused by static force of the needle on the record.

A horizontal wire is used as the fulcrum of the bell crank lever. Use of the wire eliminates any lost motion which would occur with less than perfect pivots. And the wire combines both high longitudinal stiffness with high compliance to lateral and vertical movement in the plane perpendicular to the one in which the stylus lies. The bell crank imparts motion to the transducer from vertical stimulation of the stylus. Motion in the perpendicular plane (horizontal in Fig. 2) is ignored since the bell crank pivots about a vertical axis which includes the drive point and the wire virtual pivot. Motion in the quadrature plane does not impart a twisting moment to the element.

TWO BELL CRANKS

In the actual cartridge, there are two bell cranks 90 deg. apart with a common stylus and wire pivot. The two drive points form a right angle about the wire pivot in the plane of the elements. The lever couples the transducer rigidly to the record at the drive point and the undriven end is clamped. Since there is no lost motion between the stylus and ceramic cantilever, the voltage generated is proportional to displacement of the stylus.

A second ceramic cartridge uses a single ceramic element in the form of a cylinder, as shown in Fig. 3. The tube is made of lead zirconia titanate and is electroded on the inner and outer surfaces with conductive silver. The outer electrode surface is divided into four quadrants and the element is polarised as shown in Fig. 4A.

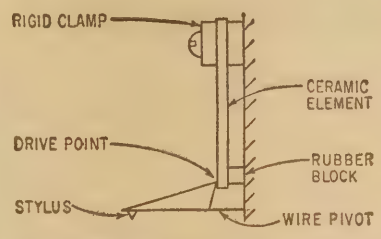


FIG. 2—Bell crank drive of ceramic cantilever for stereo pickup (Columbia)

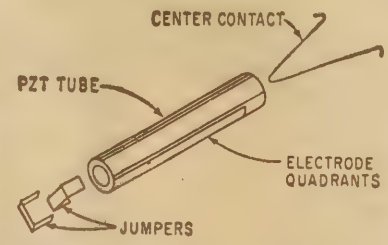


FIG. 3—Ceramic cylinder used in single-element cartridge (Electro-Voice)

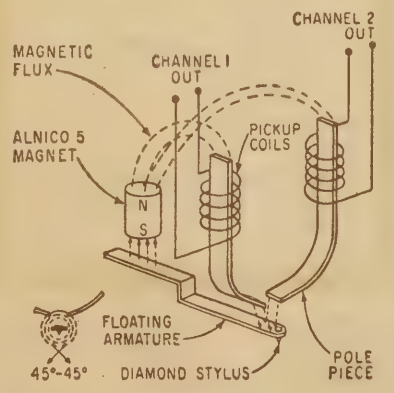


FIG. 1—Magnetic stereo cartridge (General Electric)

To operate the element as a bender, it must be connected in parallel with opposite diagonal quadrants bridged. The centre electrode is grounded for maximum interelectrode shielding. When properly polarised, a force A applied to produce a bend about axis 1, 2 in Fig. 4B will stress one quadrant in tension and the opposite in compression. A force B applied to produce a bend about axis 3, 4 will stress the other quadrants of the element to generate a potential with respect to ground. In both cases, the electrodes adjacent to the neutral plane will be stressed in the same direction and the generated potential will be cancelled. Figure 5 shows a phantom view of the complete cartridge.

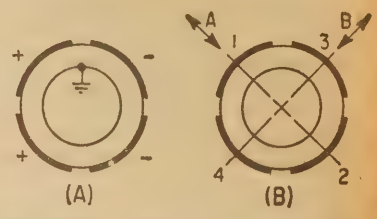


FIG. 4—Four quadrants and polarization of ceramic element (A) and bending forces (B)

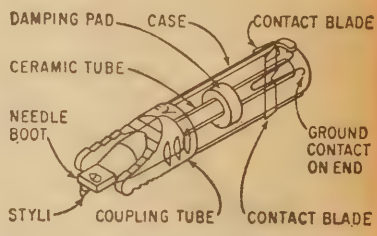


FIG. 5—Mechanical drawing of complete single-element cartridge

FURTHER DESIGN

Still another design is used in the Pickering unit.

Basic functional configuration of the design is shown in Fig. 6. This is a front view of the pickup along a line parallel to the record surface and shows the front end of the armature with the stylus attached.

The armature is free to move in any direction in the plane of the drawing.

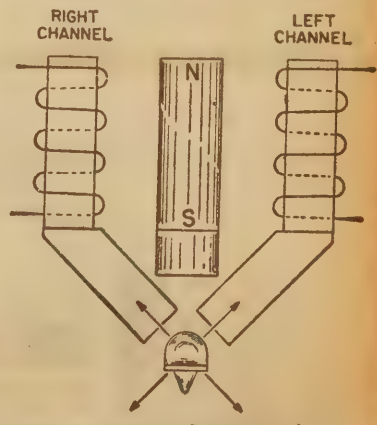


FIG. 6—Basic configuration of stereo pickup design. Magnet is located behind plane of the drawing.

STRIP . . .

copper screenings from cable

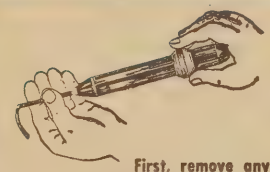
QUICKLY AND EFFICIENTLY!

A TIME REDUCING TOOL FOR USE IN: Manufacturing of TV, Radio and high frequency electronic equipment and other applications where screened cables are constantly used.
The purpose of this tool is to push the inner core of screened leads or co-axial cables sideways through the screening.

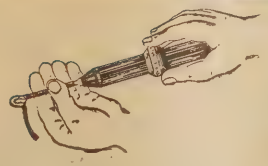
At present the Wire Ejector is available with nozzles No. 12 (.120" inside diameter), No. 14 (.140" inside diameter). Other sizes will be available in the near future to cover the full range of screened leads in common use.

SCOPE WIRE EJECTOR

(Not an electrical tool)

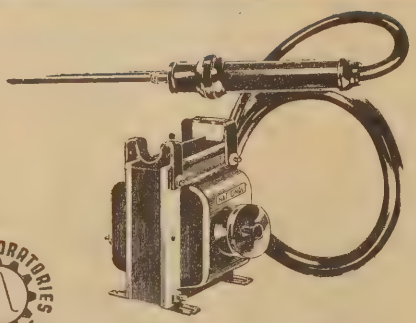


1 First, remove any outer insulation over the braiding of screened leads. Insert nozzle of tool between copper screening and the insulated core of the cable to the required depth.



2 Use the pointed end of the nozzle to penetrate between the strands of the braiding.

3 Hold the braiding over the nozzle between two fingers, push the ring on the handle forward. This will eject the cable through a side hole in the braiding as illustrated.



SCOPE SOLDERING IRON

The standard soldering iron for all radio, electrical instruments and light sheet metal work. HEATS UP IN SIX SECONDS. Scope is speedy, efficient and its effectiveness is equivalent to a 150 watt iron. Operates from AC mains with National Transformers optionally supplied or from any suitable car battery.

RETAIL PRICE: IRON 50/- . TRANSFORMER 49/7

Ask your local supplier to demonstrate these Scope tools.

SCOPE LABORATORIES MELBOURNE

N.Z. DISTRIBUTORS: H. W. CLARKE, Auckland and Wellington.

Australian & Overseas Agents:

WM. J. McLELLAN & CO. PTY. LTD.

126 Sussex St. (just North of King St.) Sydney. BX1121

MANUFACTURERS OF SCOPE LABORATORIES, MELBOURNE, VICTORIA

The magnet is behind the drawing plane and located centrally between the two separate branches of the magnetic circuit. Extensions of the magnetic polepieces come down at 45 deg. to the record surface as shown.

The magnetic circuit is completed by the armature connecting the lower end of the magnet to the two cores inside the coils.

Motion of the stylus along the 45 deg. line up to the left modulates the flux in the left-hand leg but not in the right-hand leg. And the reverse situation modulates the flux in the right but not the left leg. The two coils are separate electrically and provide the two electrical signals.

In actuality, a push-pull arrangement is used with four coils. Two are used for each channel as shown in Fig. 7. The magnet is located in the centre between the four coils. The only moving

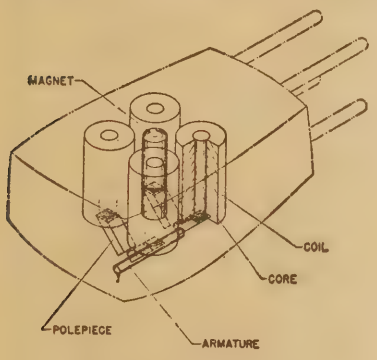


FIG. 7—Active push-pull design.

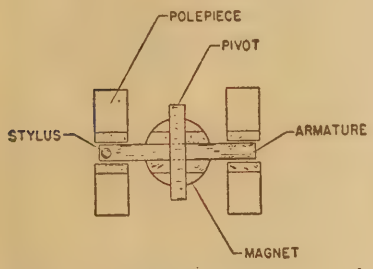


FIG. 8—Simplified bottom view of pickup.

part of the pick-up is the armature—a single straight tube placed along the bottom of the structure parallel to the record surface.

Figure 8 is a simplified bottom view of the pickup. The armature is pivoted at its centre in a bearing allowing the stylus end-free motion in all directions in the plane perpendicular to the record surface. The front end of the armature is coupled to the magnetic circuit through the two 45 deg. pole pieces at the front of the cartridge. The other end of the armature is also coupled to the magnetic circuit through two identical pole pieces at the rear of the cartridge.

As the armature moves, it modulates the magnetic circuit at the rear of the cartridge with an amplitude equal to the modulation at the front but 180 deg. out of phase. Coils are phased so that the two signals in each channel are added. The push-pull arrangement gives higher signal level, minimum distortion, and dynamic mass reduction. It provides also hum-bucking against external magnetic fields.

The complete moving system is on an insert which the user can put in the pick-up or remove easily. Two different inserts are available. One has a moving system with the maximum compliance usable on the best quality record changers. The other has the additional compliance which can be accommodated by a top quality manual arm.

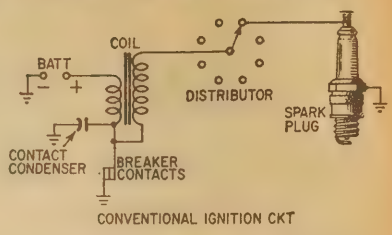
TRANSISTORS MAKE CARS RUN BETTER

Transistorised ignition for automobiles, using a power transistor to switch heavy current in the primary of the ignition set-up transformer, has been developed by Electric Auto-Lite Co.

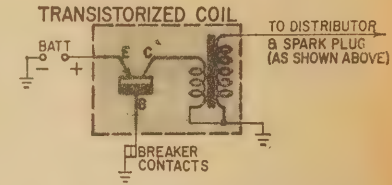
The company showed a package slightly larger than the conventional ignition coil which it replaces. They stated that starting failures and poor starting due to "blued" distributor contacts are greatly reduced, the contacts last much longer due to lower current through the distributor, ignition maintenance and adjustment is reduced, and the ignition "condenser" is eliminated.

Auto-Lite designed the system around a power transistor which switches the heavy current required in the ignition coil primary. The emitter-collector circuit of the transistor carries this current and is triggered by the distributor contacts which are placed in the base of the transistor, thus timing the firing of the transistor-witched transformer to the engine. The distributor contacts function in their normal manner except that they carry very low current (less than 250 ma instead of 4 or 5 amps!). Through the action of the transistor and improved stepup transformer design made possible by this system, it delivers greatly increased voltage to the spark coil.

The unit mounts in place of the ignition coil which it replaces. It contains



CONVENTIONAL IGNITION CKT



TRANSISTORIZED HIGH-VOLTAGE IGNITION SYSTEM

the power transistor, heat sink, stepup transformer and associated circuitry. Two primary terminals and a high-voltage secondary terminal appear just as on the conventional ignition coil.

Additional advantages accrue from the improved transformer design and increased dwell time, which raises available transformer output voltage at high speeds. The new system can be installed in any battery ignition system quickly. Initially it will cost about as much as power steering. The company anticipates that it will be available as operational equipment on cars in 1961.

COLD-SOLDERING USED TO SEAL TRANSISTORS

The small size of transistor assemblies has posed many production problems, and ideas, old and new, are constantly being adopted to increase both speed and efficiency.

Molecular Adhesion will join freshly soldered surfaces in a mechanically strong thermal and electrical bond when the surfaces are placed in contact under pressure. This technique, called cold-soldering, is used to hermetically seal transistor assemblies at the RCA Semiconductor and Materials Division plant, Somerville, N.J.

Cases are prepared with a bead of solder around the inside lip. Resincore solder preforms are spread on a flat surface. The open ends of the cases are pressed over the preform rings so the rings wedge in place. The cases are placed on an asbestos-covered turntable which carries them under a gas flame, melting the solder into a bead on the lip.

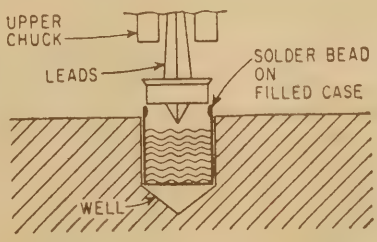


Fig. 1—Tinned surface of transistor stem makes with solder bead.

The bead is reamed to mate with the transistor stem assembly. A turntable with chucks around the outer circumference is used. Each chuck opening is tapered so that the first impact of the reamer bit seats the case, preventing it from spinning or pulling free when the bit withdraws.

A standard twin-head reamer is used. The table indexes 2 cases at a time. After reaming, a knockout frees the cases from the chuck. As the cases are freed, high pressure air removes chips and blows the cases down a discharge chute. The cases are cleaned by vapour degrease and filled with dielectric fluid.

Cases and stem assemblies, which are solder electro-plated before assembly, are hermetically sealed in a controlled atmosphere chamber containing a conventional small air press. Press pressure is 50-60 psi. The bed of the press is stationary.

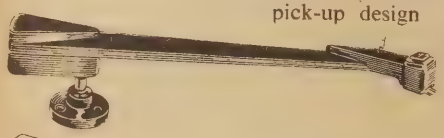
Using tweezers, the operator places a filled case in a well in the press bed. She then places a stem assembly over the shell, using tweezers, so that the stem leads fit up into a hole in the upper chuck (Fig. 1).

The press is operated with palm switches. Friction holds the case of the sealed transistor in the press bed so that the leads pull free of the upper chuck.

offering you the widest range of pick-ups . . .

CRYSTAL MAGNETIC • CERAMIC

plus these acos replacement cartridges



BLACK SHADOW is a new concept in crystal pick-up design. Supplied with Selector Box and Black Shadow L.P. cartridge with Diamond stylus. Complete.

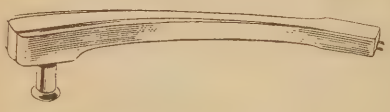
PRICE £17/15/0

HGP40: A de-luxe crystal pick-up complete with separate standard and micro-groove heads. (HGP-39 std. and HGP39 L.P. cartridge)

PRICE £9/15/0

GP32: Magnetic pick-up provides a good standard of reproduction with normal equipment at low price. Output voltage, ½ volt at 1,000 c.p.s

PRICE £2/12/6



GP66: Series of lightweight pick-up with die cast arm construction increasing torsonial rigidity, minimising arm resonance

Complete (with GP65-1 or GP65-3 cartridge) . . .

PRICE £5/7/6

HGP38: A crystal pick-up. Incorporates the HGP37 turnover cartridge for standard or micro-groove recordings with cantilever stylus

PRICE £5/15/0

GP50: Is a HIGH-OUTPUT crystal pick-up suitable for reproducing standard and microgroove records through low gain amplifiers as used in small record players (GP59-3 cartridge) **PRICE £4/19/6**

GP60: Incorporates the latest type CERAMIC cartridge—unaffected by heat or humidity. For use in tropical areas (GP61-1C cartridge) **PRICE £6/16/**

GP10: Is a crystal pick-up utilising the GP9 cartridge, combining purity of reproduction with extreme reliability, resonance-free response from 50/8,000 c.p.s. Output 1.5v at 1,000 c.p.s. (GP9 cartridge).

PRICE £3/12/6

HGP39 CARTRIDGE

Low element mass and very high compliance enables the heaviest modulation possible to be traced with a minimum of record wear. Both standard and L.P. heads available.

PRICE £3/12/6

GP9 CARTRIDGE

Famous as the cartridge with the unbreakable crystal. Takes standard steel or fibre needles for 78 r.p.m. records.

PRICE £1/11/6

GP59 CARTRIDGE

A High output turnover cartridge suitable for reproducing standard and microgroove records through low-gain amplifiers

PRICE £2/3

GP61 CARTRIDGE

A Ceramic turnover cartridge that will withstand the the rigours of a tropical climate and is, at the same time, very robust **PRICE £3/19/6**

HGP37 CARTRIDGE

A Crystal turnover cartridge with cantilever stylus that utilises a new method of crystal drive, a bisectional control element that achieves independent characteristics for standard and microgroove.

PRICE £2/18/6

GP65

Turnover crystal cartridges available in two types, medium output High Quality or High output with smooth well-balanced response

BLACK SHADOW CARTRIDGE

Fitted with diamond stylus to be used with Black Shadow arm and Selector

FREE

Write now for illustrated technical literature on any of the products shown on this page

Sole Agents in Australia

AMPLION (A'SIA) PTY. LTD.

101 Pyrmont Bridge Rd.,
CAMPERDOWN, SYDNEY N.S.W
Phone LA6124

NEWS AND VIEWS OF THE MONTH

Hope for castaways

IT is better to drink salt water in small quantities than no water.

That is the advice of Dr Gabrielle Aury, Chief Doctor of the French Navy, to survivors of crash landings at sea.

In a series of tests he conducted jointly with Jean Le Houerou, safety and survival expert for Air France, he drank nothing but salt water for six days.

M. Le Houerou was on the salt waggon for three days.

Dr Aury recommends that seawater be swallowed in small quantities, roughly 10 cognac-size sips a day.

This is one of several Arctic and desert survival techniques developed by European Airlines.

Although their transpolar crews have all been coached by American Air Force experts, they have improved on the standard military equipment.

They have found that much of the military survival gear is not suited for untrained civilian passengers.

Key British rocket

BRITAIN'S "Blue Streak" rocket has been hailed as a key weapon by United States missile experts.

They are saying that the "Blue Streak" would be able to hit an enemy harder, quicker and more accurately than any other weapon.

The Americans regard the "Blue Streak" as important because it would be based in England, and so nearer to a potential enemy.

Secondly, it would be in "hard" underground sites virtually proof against H-rocket attack.

Tests have proved the rocket could be kept ready with fuel for years.

The "Blue Streak" is scheduled to be tested at Woomera range shortly.

Hans Guenter Noeller, a physician of Heidelberg, West Germany, holds in a pair of tweezers the tiny short wave transmitter for stomach examinations he has developed after four years work. The tiny instrument, 20 millimetres long and 6.5 millimetres in diameter, is used to examine acidity concentration in the stomach and is swallowed by the patient. It transmits signals which change according to the concentration of acidity. Signals are picked up by a special receiver seen at the right.

Radio-active flies

THE U.S. Army is using radio-active flies and mosquitoes experimentally

Army chemists have begun producing radio-active mosquitoes so that their movements can be traced and their disease-spreading potential can be studied

Knowledge of the flight range and dispersal pattern of insects is an important factor in disease control.

The traditional method used for tracing insects is to spray them with either a metallic powder or a dye and then release them.

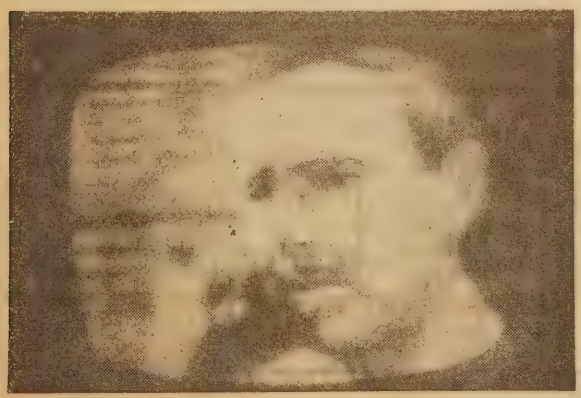
The disadvantages of this is that the spray decreases the insects' flying ability and also makes it necessary to examine each insect individually.

By making the insects radio-active, however, they can be traced easily with an ordinary Geiger counter.

The insects are made radio-active by being fed on radio-active glycogen or radio-active sugar.

They are nourished on these while still in the larva stage.

Thorough tests already have been made in the Hudson Bay region of Canada.



☆

Mr R. Fairbairn, of 38 Salisbury Rd., Richmond, Nelson, New Zealand, sends this picture he received of ABV, Melbourne, on his TV set. He reports frequent good reception particularly of ABN, in the summer months.

☆

Top Russian fighter

RUSSIA'S latest MIG fighter is a 1,500 mile-an hour aircraft with three cannon in the nose.

It also has a rocket engine under the tail to give it another 10,000 feet of altitude.

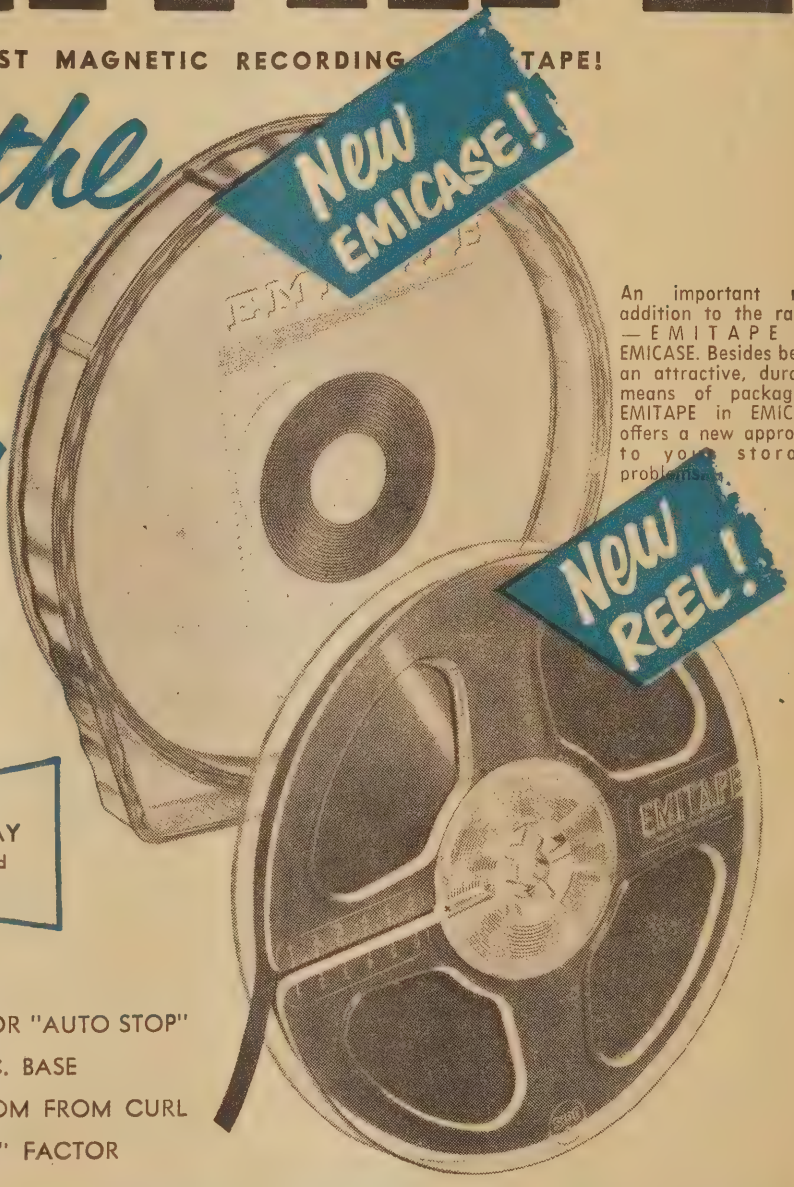
NATO sources know the plane—the MIG-21—under the code name "Faceplate."

The U.S. Air Force considered its F-104 Starfighter a better high-altitude

EMITAPE

THE WORLD'S FINEST MAGNETIC RECORDING TAPE!

-with the NEW look!



An important new addition to the range — EMITAPE in EMICASE. Besides being an attractive, durable means of packaging, EMITAPE in EMICASE offers a new approach to your storage problems.

"88" GENERAL PURPOSE

"99" LONG PLAY 50% increased playing time

- ANTI-STATIC
- METALLIC CONTACT STRIPS FOR "AUTO STOP"
- PRE-STRETCHED P.V.C. BASE
- HIGH SENSITIVITY
- FREEDOM FROM CURL
- LOW "PRINT THROUGH" FACTOR

DISTRIBUTED BY:

TR.38.FP

E.M.I. (AUSTRALIA) LIMITED
Engineering Sales Division
301 CASTLEREAGH STREET
SYDNEY, N.S.W.

SOUTH AUST.: **E.M.I. (AUSTRALIA) LIMITED** 265 Rundle Street, Adelaide S.A.	*QUEENSLAND:* **A. E. HARROLD LTD.** 123 Charlotte Street, Brisbane Qld.
VICTORIA: **E.M.I. (AUSTRALIA) LIMITED** 167 Flinders Lane, Melbourne Victoria	*WEST AUST.:* **E.M.I. (AUSTRALIA) LIMITED** 73 King Street, Perth, W.A.

interceptor than the new Soviet MIG, the New York "Journal American" says.

It added that the Communist East German Air Force was being trained in flying the MIG-21 and the planes had been seen among Communist Chinese squadrons.

The paper said the plane had been developed by Artem Mikoyan, brother of Soviet First Deputy Premier, Mr Anastas Mikoyan.

It was considered to represent "the best the Soviet has in production today."

The MIG-21's main engine is a modified jet of the type used in the Soviet TU-104 airliner.

It has a range of about 1,000 miles

The plane mounts 18 unguided missiles and four of the infra-red or heat-seeking guided kind.

Sun grows brighter

THE sun had become two per cent brighter and probably correspondingly warmer in the last five years, an American astronomer reported.

Astronomer William Sinton, of Lowell Observatory, at Flagstaff, Texas, said measurements of the brightness of the planets Uranus and Neptune had proved the seemingly steady sun was a variable star.

The observed change might help unravel the mystery of the earth's Ice Age.

Life on Mars?

MANY scientists now believe that life of a primitive nature exists on Mars.

Some scientists remain sceptical, but recent studies have bolstered the life-on-Mars theory.

Researchers at the Air Force School of Aviation Medicine at Randolph Field, Texas, devised experiments to test whether certain organisms, such as bacteria and fungi, could survive under conditions similar to those on Mars.

The organisms were placed in jars filled with nitrogen at a low pressure, corresponding to the Martian atmosphere. They were then exposed to sudden temperature changes—from 77 degrees above zero to 13 below.

Organisms requiring oxygen died, but those needing little or no oxygen survived and even grew. The experiment suggests that at least some forms of life known on earth could survive on Mars.

Even before these scientific reports a survey of scientists, mostly astronomers, showed overwhelming belief in Martian life of some type. Only one scientist of 37 queried said no.

Fortune on the moon

SOME scientists believe that whoever wins the race to the moon might be rewarded with a fortune in diamonds.

Moon craters shaped like huge ice-cream cones could be an indication of diamond deposits, they believe.

Dr G. P. Kuiper, of Yerkes Observatory, Williams Bay, Wisconsin, has said the craters appeared similar to the funnel-like craters topping the Kimberley "diamond pipes" in South Africa.

Dr Kuiper reported the moon crater discovery at a space symposium at the National Academy of Sciences in Washington.

Dr Harold C. Urey, Nobel Prize-winning scientist of the University of California, said pressures inside the moon were sufficient to create diamonds.

STEREO

Grampian

Stereo Amplifier
590/2 £91

The release of the new stereo recordings has meant that a new approach must be made when considering your equipment, for although stereo reproduction has many advantages it may not be convenient to install a full system at once.

The new Grampian "590" series has been produced specially to meet this condition and enables you to commence with a "mono" or single channel system at once, and convert to stereo at any time.

Output Impedance 4 and 15 ohms.
Output Power 7 watts (R.M.S.)
(each channel) 10 watts (peak)
Input Impedance P.U. 1 Megohm.
Input Impedance Tuner/Tape, 0.5 Megohm.
Input Sensitivity PU. 0.5 volts.
Input Sensitivity Tuner/Tape 1 volt
Hum and Noise. —60 db.

Distortion at full output less than 1 p.c. at 1 k/s.
Controls Balance. plus/minus 4 db on each amplifier, total 8 db.
Bass. plus/minus 8 db at 40 c/s.
Treble. plus/minus 10db at 15 k/cs.
Selector. Tuner, 78 L.P. Stereo disc, Stereo tape.

LEAK

An outstanding Stereo Amplifier from the house that has produced the top-quality monaural amplifiers.

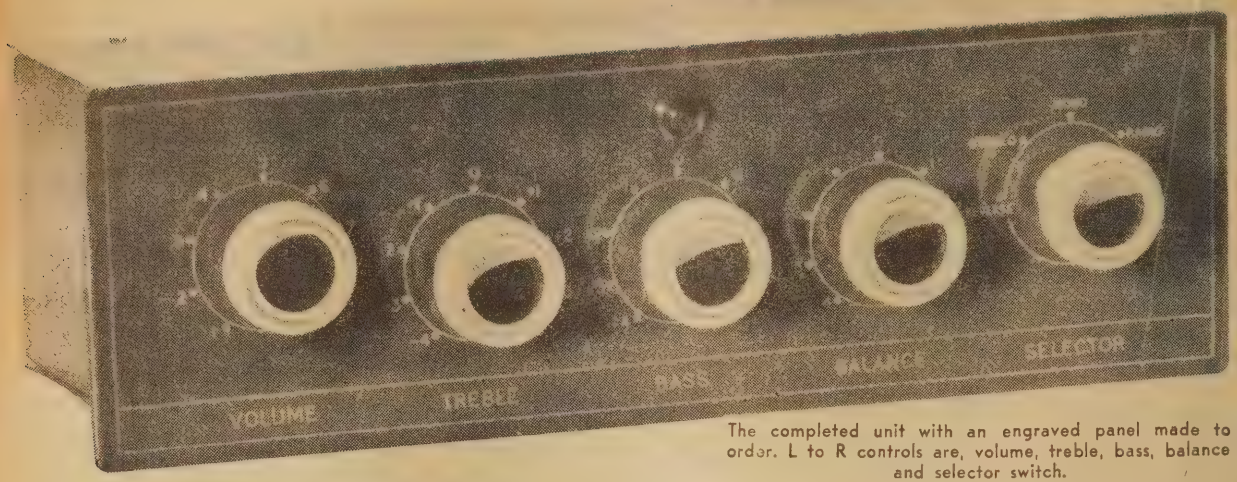
Stereo Amplifier
. . . complete unit
Point-One Stereo
pre-amplifier
£147

Grampian Mono Amplifier 10/15
£43/8/-

Grampian Pre-Amplifier Type 582
£34/10/-

For further information, write to:—

CHANDLERS
PTY. LTD.
Cr Albert & Charlotte Sts., BRISBANE. 310341.



The completed unit with an engraved panel made to order. L to R controls are, volume, treble, bass, balance and selector switch.

Stereo Tone Control For Low Inputs

Here is a practical design for a tone control unit intended for our recently described 10 and 17-watt amplifiers and suitable for magnetic pickups. Sensitivity and compensation curves may be varied over wide limits by using various component values.

by John Moyle

NO program of stereo equipment would be complete without adequate attention to tone control units for use with magnetic type pick-ups and for some little time we have been considering what would be best to do about it.

By magnetic pick-ups we generally mean those of the moving iron or moving coil type which have a constant velocity characteristic, and which as a class have a much lower output than the crystals.

Because of this they require such different treatment as to create an entirely different design problem.

The crystal pick-up when fed into a load of one or two megohms can be made to give output almost an exact reciprocal of the modern recording curve, and there is no need for further basic compensation.

MAGNETICS ARE DIFFERENT

But the magnetics are quite different. They require compensation circuits which provide bass boost and treble cut to restore the initial recording curve to a flat condition.

And because their initial output is mostly well below 50 millivolts as against 300 or more for the crystals, extra amplification must be included. Some of the magnetics have outputs as low as 5 millivolts from a standard test disc, while others, through the use of transformers or other features in design, will deliver more than this.

However, it seems that we must be prepared for pickups of this type to average between 5 and 10 millivolts although they will naturally achieve a much greater output on peaks.

Undoubtedly, designers are working on the problem of producing higher output, but, with the physical limitations forced upon them, it is hard to visualise much improvement for the time being.

Even the wide range ceramics, which appear to have a rosy future, are not doing a great deal better, although the difference is enough to make them well worth watching.

All this makes it rather hard for the designer of a control unit.

To cater for such a wide variation, he is often forced to produce a stable, distortionless circuit at a sensitivity of below 10 millivolts, and, remembering the incidence of an extra bass boost control which will lift the 50 cycle point by up to 15 db in addition to a further 15 db already built into the equaliser, his hum problems can be considerable.

So can the noise from the valves, or at least the first in the chain, unless he takes special precautions.

Stereo hasn't made things any easier for design, as mostly stereo magnetics have even lower outputs than their mono forefathers. So far only a few types have been obtainable in modest quantities in Australia, and the general requirements in the way of sensitivity aren't sufficiently clear, nor has the opportunity and time for experience been sufficiently great for us to form a fast opinion on just what input figures are required.

What is really needed is a time-consuming program of collecting and testing a wide range of pick-ups in conjunction with a given control unit design, but so far this hasn't been possible.

Only a few types have yet found their way here, and specifications overseas change sufficiently often to indicate the operation of amended designs referred to above.

PRACTICAL UNIT

For this reason we have hesitated to produce a hard and fast design even though the starting point seems reasonably clear.

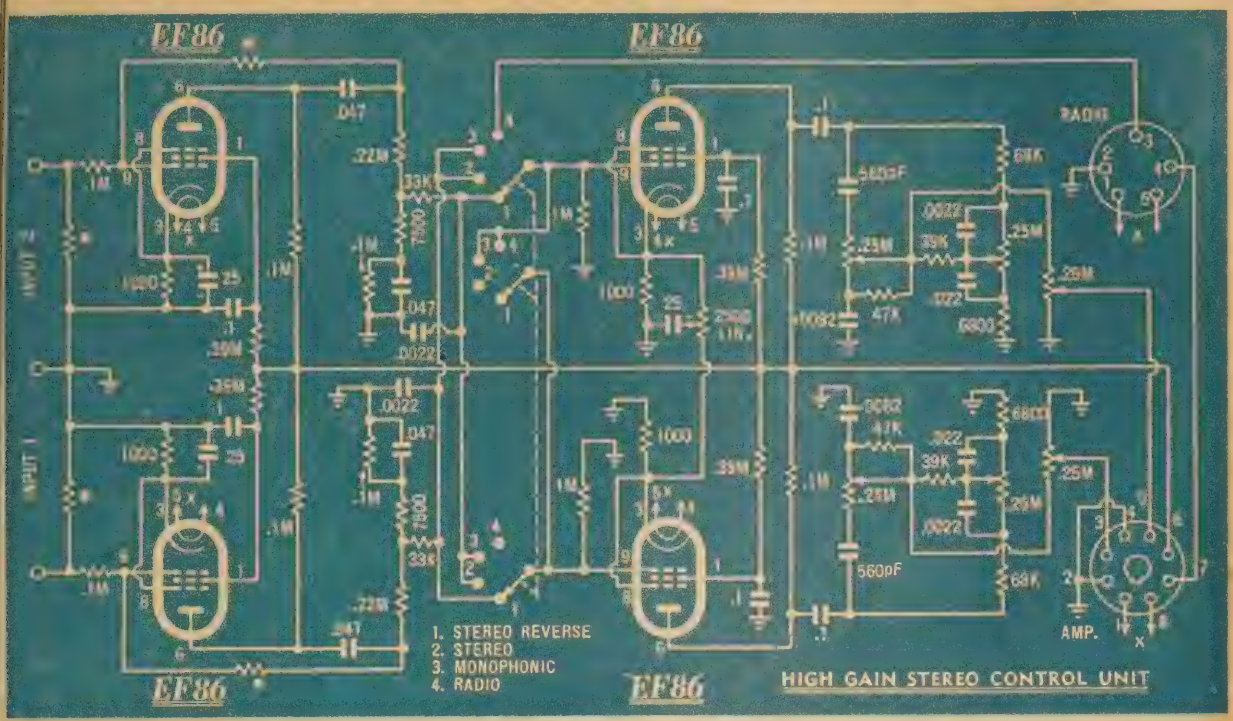
But we have developed a simple and logical approach which might yet prove as good as any in its class, and there seems no reason why the details should not be given for the benefit of the many readers who are asking for them.

For this reason this unit is presented in the knowledge that it represents a basic and practical solution, capable of adaption to meet many cases, and with excellent characteristics as far as it goes.

At a later stage we may be able to suggest minor modifications to fit in with later knowledge of the situation.

When looking at the over-all requirements, we set down not necessarily the things which we personally preferred,

BASIC CIRCUIT FOR MAGNETIC CONTROL UNIT



This basic circuit has proved to be quite successful. No feedback is used for maximum sensitivity, but can be added to accommodate higher output pickups. The .1 meg isolating resistors are only needed with feedback. The input resistors are selected to suit the pickup. Plate and screen resistors should be high stability types. All components in the equalizing and tone control circuits should be 5 per cent values.

but those which the majority of people seemed to like.

For example, there are two schools of thought about auxiliary tone controls.

Our preference has always been for the switched type in which bass and treble are cut and boosted by known amounts in fixed steps.

This is the only method which allows one to be quite certain that a given result has been obtained, and one which can be duplicated at any time by setting controls into the same positions.

On the debit side it requires more small parts, and a switch with probably four banks, and is rather fiddly to put together.

The second type of control uses continuously variable settings built around a couple of potentiometers having strategically placed resistors and capacitors to provide the modified response.

POTENTIOMETER FAULTS

Unfortunately potentiometers are notorious for a number of faults. They often develop noise, their resistance law alters, and because of the simplified and interconnected circuitry they demand, unless multiplied in number, interaction between the bass and treble is almost impossible to avoid in the cross-over region which many do not like.

Worst of all, it is extremely difficult to arrange that, in the centre position, a "flat" result obtains. One is never quite certain just where "flat" is, despite the nice-looking numerals on the panel which purport to tell him

But they are undoubtedly smooth and simple to use, and for this reason are extremely popular.

For stereo, their constructional simplicity is even more valuable, since we must provide for two of everything. Few components can be simpler than a dual potentiometer, and the manufacturers are now able to supply components which are reasonably matched over their range so that they can be kept fairly well in step.

What is not so certain is that the exact resistance law of the element is the same in all brands, even when these are all allegedly logarithmic.

This makes it virtually impossible to specify a set of component values in which a carefully tailored zero position will be valid for every type of potentiometer.

But if these matters are not vitally important, remembering that it is always possible to set the controls where they sound best, there is still a case for using them.

For our first effort, therefore, we decided to incorporate such a system.

Again we walk into two more schools of thought. Should the circuit use the classic divider system in the output of a valve, or should it use a circuit in which the compensation is wired into a feedback circuit?

Again there are good and bad points on each side, and although we have not yet used a feedback type of control,

PARTS LIST

1 Front panel, brackets and metal work

1 2 bank 5x2 position switch

3 250K dual matched log. potentiometers

1 2500 ohm linear potentiometer

RESISTORS ½ WATT 10%

2-1 megs 4-1000 ohms 2 values to suit pickup loading (nominal .1 meg)

RESISTORS ½ WATT 5%

2-.22 megs 2-.1megs 2-68K 2-47K 2-39K 2-30K 2-7.5K 2-6.8K

RESISTORS ½ WATT HIGH STABILITY 5%

4-.39 megs 4-.1 megs.

CAPACITORS 400 VOLTS

6-.1 mfds 2-.05 mfds

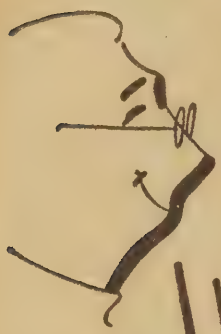
CAPACITORS 5% PREFERABLY SMALL MICA

2-.04 mfd 2-.0082 mfd 2-.022 mfd 4-.0022 mfd 2-560 mfd

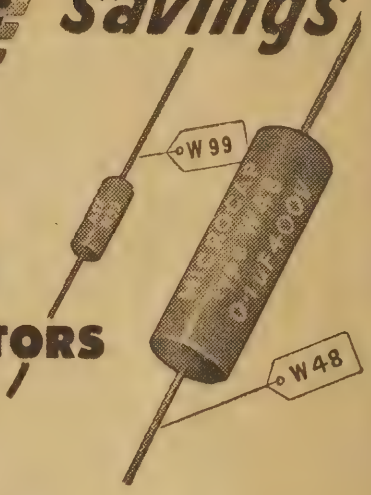
3-25 mfds 12 volt electrolytics

Sockets—4-Noval 1-octal 1-5 pin, 2 input connectors 4-8 position tag strips. 1-3 position tag strip. 1-dial light and bezel. Valves-4 EF86

You'll make DOUBLE savings



WITH Microcap CAPACITORS



SAVE ON SPACE

MICROCAP'S exclusive metallised paper construction results in a lightweight ultra-miniature space-saving capacitor, which can be fitted in a fraction of the space required for ordinary units of the same rating. Resultant overall savings in space mean worthwhile savings on cost.

SAVE ON SERVICING

Outstanding "self-healing" feature enables MICROCAP to sustain accidental over-voltage. This results in long, stable life in miniature form, reducing servicing problems, greatly overcoming the bug-bears of "intermittent" and open or short circuits.

A.E.E. TYPE W99

Available in working voltages of 200, 400, 600 V. D.C. and 300 V. A.C. in values up to .04 uF.

A.E.E. TYPE W48

Covers range .05 uF to 2.0 uF in working voltages of 200, 300 and 400 V. D.C.

Wide range covers requirements of modern design

*Registered Trade Mark

Microcap* CAPACITORS

M12.

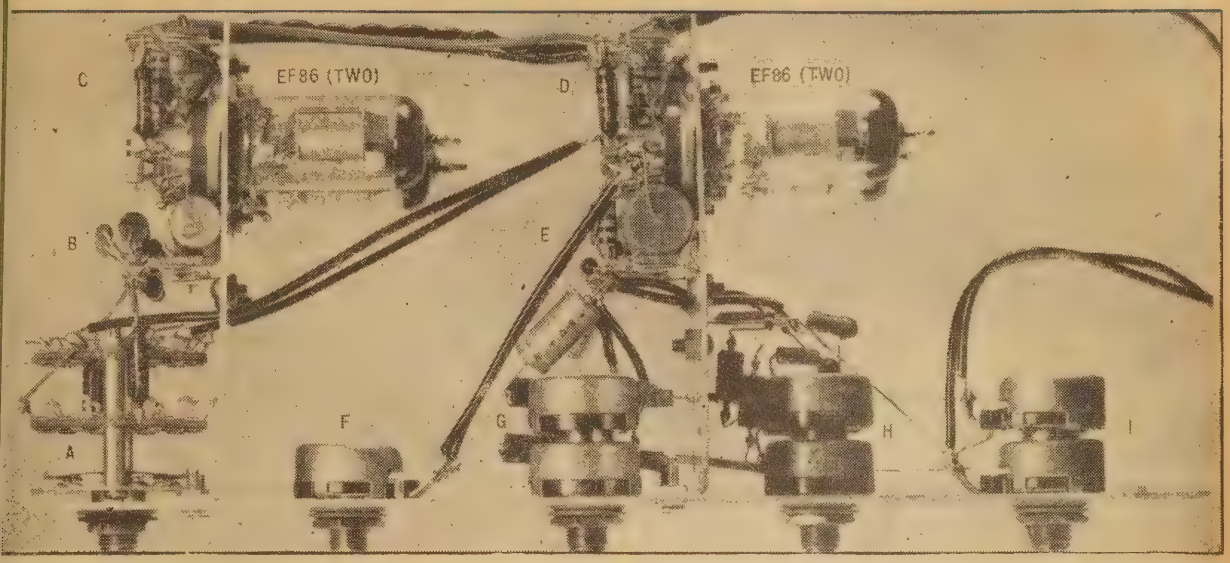
Manufactured under licence from A. H. Hunt Capacitors Ltd., London, by

Australasian Engineering Equipment CO. PTY. LTD.

476 LATROBE ST., MELBOURNE. FY 2638

N.S.W. Agents:—Wm. J. McLELLAN & Co. Pty. Ltd., 126 Sussex St., Sydney. BX1131

SIDE VIEW SHOWING UNIT TYPE CONSTRUCTION



This photograph shows the unit type construction. A is the selector switch. B is group of resistors and capacitors in the compensation network. C is the group of feed and coupling capacitors for the first two valves. Some control components are grouped at E. G is the bass potentiometer and F the balance control. H is the treble potentiometer and I the dual volume control.

there is no certainty that some day we might not do so.

The circuit principle used was given in the magazine many years ago, and as far as can be ascertained, this was the first time it was published anywhere. Today it is widely used, and rather than work out a set of constants unnecessarily we have adopted those evolved for a Mullard pre-amplifier circuit for use with standard pick-ups.

The performance curves of this network, given herewith, provide for a 30 db variation in both bass and treble at approximately 50 cycles and 10 Kc, which is the kind of performance we would want in our unit.

There is some interaction of the controls in the 1,000 cycle region, but this is one of the penalties we must accept.

Second thought at a later date might inspire us to use only bass boost and treble cut, on the assumption that neither of the other facilities is of any great value, but for the moment this one is the choice, and, by implication, it can be considered Mullard's recommended circuit for use with the EF86.

One feature we like about the arrangement is the placement of the gain controls in the output of the circuit. This means that the full noise output from the valves will be present only when the gain control is turned full on, a condition under which it it most unlikely to be a worry.

GAIN CONTROL POSITION

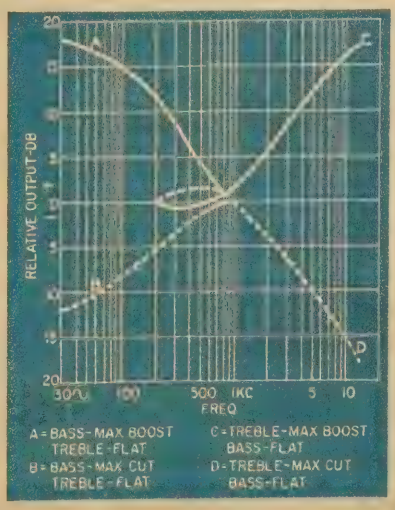
One of the less commendable features of our earlier control units was that the gain control was placed in the grid circuit of the second valve or valve section, and there have been cases when residual valve noise has bothered the user when the amplifier system was resting. And other noises attributable to the control unit are likewise reduced in a similar fashion.

There is a drop in gain of about 10 times in this stage, but we still require more sensitivity, and pick-up compensation has yet to be provided.

In order to obtain both, we looked back to the front end of the Playmaster Control Unit No. 6 which used a pair of EF86's, the first performing just the service we want here.

On the principle that when on a good thing we should stick to it, we have therefore lifted this section and added it to the design.

Because all stereo records are cut to the RIAA recording curve, there is no need to use more than a single type of compensation which greatly simplifies the circuit. We could use the same values as in the original, although our feeling is that the loss in this network is unduly large. This large initial loss allows us to be meticulous in following through considerable bass compensation at very low frequencies, but, as the practice now is to



These curves show the characteristics of the bass and treble controls.

roll these off after about 40 cycles, which frequency is rarely reached anyhow, it would be quite in order to restate these values to that end.

The overall gain of the stage would be raised thereby, and that of the whole unit might become uncomfortably high but as you will remember we have a plan about that in the form of a feedback over the first stage by which the gain may be adjusted to almost any desired figure, if required.

This is accomplished by the very simple addition of a resistor from plate to grid circuit, its value being selected to suit the pick-up we are using.

There is little use in having more gain in the unit than is necessary to provide maximum output from the average record.

A value of feedback resistor is therefore selected which will provide this with the gain control wide open.

Several things are accomplished by doing this. One is that the maximum amount of feedback is used over the first stage, and this reduces distortion, which is already low.

The second is that, by reducing the voltage feed to the grid of the second valve to the minimum required, distortion is reduced in this stage also.

LOW DISTORTION

This is quite important, because, having our gain control at the end of the chain, the second valve will be operating with the same order of input voltage irrespective of its setting.

Remembering that the output required from the unit at centre frequencies is only about .2 volts, you can establish by reference to charts showing stage gains of the EF86 that the grid swing required to obtain it is a mere fraction of a volt. Adjusted in this manner, therefore, the distortion contributed by the unit, even without feedback, is extremely small.

The design allows the unit to drive

MORGANITE insulated COMPOSITION RESISTORS

TYPE 'AS' ½ WATT
5/32" x 3/8" Long

TYPE 'AY' 1 WATT
7/32" x ¾" Long

RESISTANCE RANGE
Available from stock in preferred values from 10 Ohms to 10 Megohms; but to order range can be extended to both higher and lower values.

ELEMENT
Moulded carbon composition.

INSULATION
Moulded phenolic composition. Breakdown exceeds 1500 Volts.

TERMINATIONS
Silver coated copper ensuring easy certain joints. Firmly moulded into resistor element to withstand close bending without failure of lead or connection.

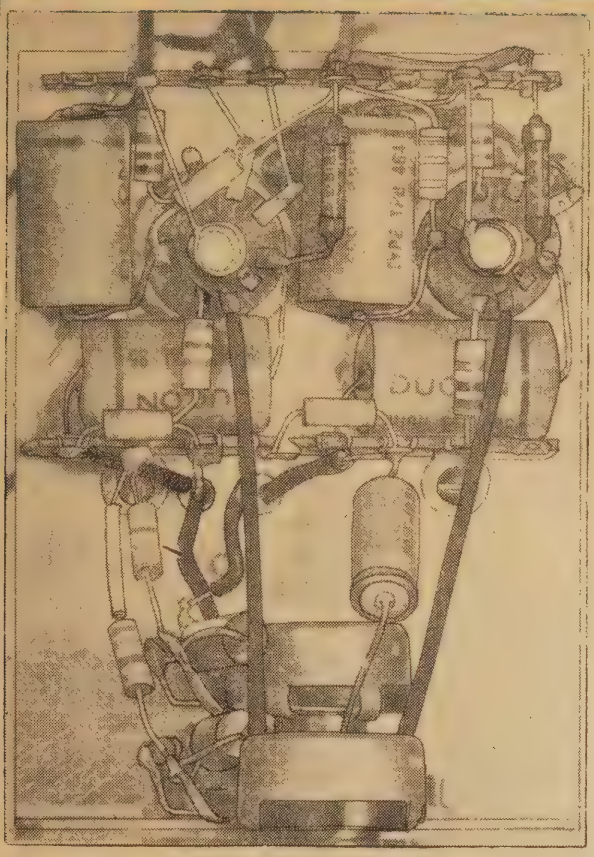
TOLERANCE
Stocked in full range at 10% tolerance. 5% and 20% supplied to order.

SAMPLES AND PRICES ON REQUEST

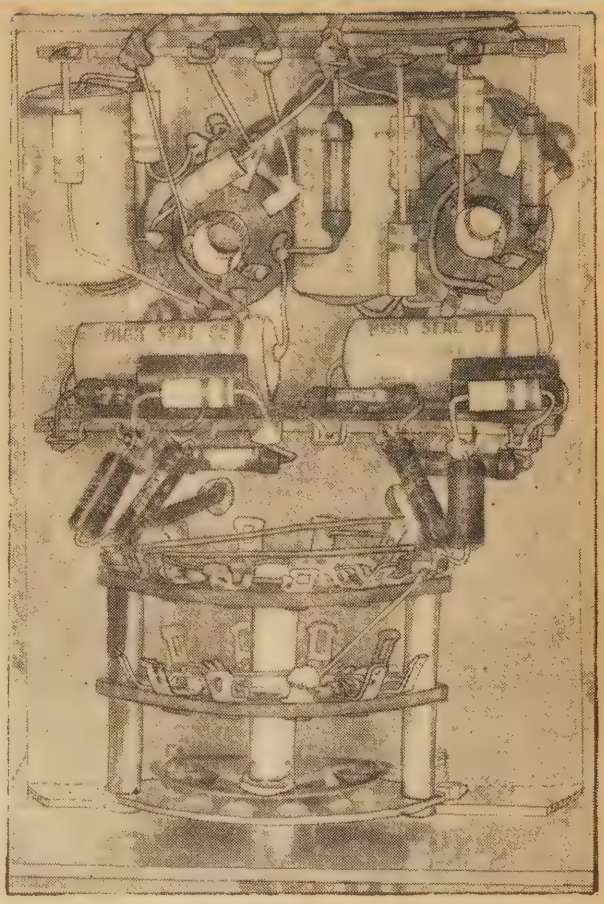
THE MORGAN CRUCIBLE CO.
(AUSTRALIA) PTY. LTD.

HEAD OFFICE:
[illegible] ALEXANDRIA, N.S.W. PHONE [illegible] TELEGRAMS "MORGANITE" SYDNEY
577 THE[illegible]WAITE ST. SOUTH MELBOURNE, S.C.5, VIC. Phone: MX6106. Telegrams: "CRUCIBLE," MELBOURNE

ASSEMBLY DETAILS FOR THE MOUNTING BRACKETS



Photograph showing the centre bracket and its associated wiring. Filament and power connections are at the top tag strip.



A photograph of the second bracket. Again the compensation components are grouped on the centre tag strip. Connections at the rear, L to R, are, input 1, earth, two filaments, HT, input 2 earth and HT.

the 10-watt stereo amplifier to full output with 15 millivolts input to the first grid.

This means that there is virtually nothing to spare in sensitivity, although actual experience with our circuit connected to the 10-watt stereo amplifier shows it to be enough for very high volume using both the Ortofon and GE pickups, two representative types.

In this it is comparable with a high quality commercial unit we have been using for test purposes.

During the next few weeks we intend to re-examine the values of components in the compensation circuits to establish those which will give substantially the curves we want and allow the maximum gain.

This may entail allowing the extreme bass end to roll off sooner than at present, but indications are that this would be desirable.

At high volume, the danger of acoustic feedback in this region is much greater with stereo because of the contribution to output of vertical as well as lateral movement.

Without a reasonable roll-off, it can be quite a hazard.

In normal use, there is no point in extending full response below 40 or 50 cycles, a point which now seems to be realised by the recording industry.

We would like to reach a maximum sensitivity of about 5 millivolts when feeding an amplifier with a sensitivity of 200 millivolts as a basic design, and this cannot be done with two such valves without particular care.

No fundamental circuit change will be needed for this, but we certainly will not be able to add feedback to the first stage to accomplish it.

But, by adding feedback, the unit could then be used with almost any pickup, even crystal types suitably loaded.

BALANCE CONTROL

Some reduction in gain and detection is obtained from the circuit used for the balance control which, in its central position, provides for a virtually unbypassed cathode in each of the valves in the second stage and about 7 db of feedback as a result.

The whole thing appeals as being rather a neat combination of circumstances, and capable of some interesting experiment by the builder.

When a more representative selection of pick-ups is available for test, it should be possible to go back over circuit values, as already indicated, and perhaps restate some of them to hard and fast figures.

It might even be useful to do so in the interests of obtaining optimum compensation as a whole, for the settings of the auxiliary controls will almost certainly modify the validity of the initial compensation, if we are to adjust them for a close approximation of R.I.A.A. with both bass and treble in the centre position.

Unfortunately this interlocking of knob settings can precipitate a rather laborious set of tests as being more practical than calculation, and many may not consider it worth the trouble.

The balance control is not an easy thing to provide if we want to swing completely across from one channel to the other, varying each from full gain down to zero. It is very nice to do this, but not really necessary.

All we really require is some means which will create a difference in gain between channels sufficient to make up for any possible difference due to recordings, assuming that speaker unbalance would be tackled by some more permanent correction.

The balance control allows us to swing a cathode bypass capacitor from one valve to the other so that we can add or subtract 7 db from either side of the amplifier. This gives us a total variation

TRADE IN YOUR OLD INSTRUMENT

Test instruments have advanced greatly in recent years, so why not trade in your old instrument on a new, more comprehensive model? You will receive a good price for your old instrument (regardless of manufacture), which will pay much towards the cost of your new instrument.

A.W.A. Voltohmyst, ideal for all electronic applications. Light, portable, accurate, rugged construction. Reads AC volts, rms. of Sine wave to 1500 P-P to 4,200. DC volts plus or minus to 1500. Current to 1500mA. Resistance to 1,000 megohms. Wt. 8½lb.

PRICE: £42
Plus tax 12½ per cent.

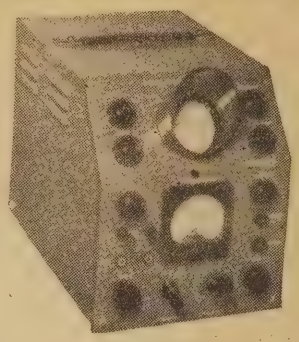
Selling your old test equipment? Let Thyron Radio Supplies sell it for you quickly and economically. Details on request.

- Literature available on all instuments, AWA, Paton, etc.
- Easy terms available on ALL test equipment. All NSW, and certain towns in Victoria and Queensland.
- If you have a test instrument requirement, regardless of make, local or overseas, let us know. Demonstrations of equipment may be arranged for any time, day or evening to suit you. You are under no obligation to purchase.
- Trade-in service applies to all States. Attractive freight conditions

City—Country—Interstate

THYRON RADIO SUPPLIES

233 Victoria Road, Gladesville, N.S.W. WX3428



The E.M.I.-W.M.S. measuring oscilloscope is a portable, wide-range instrument for radio, TV and general electronic applications. Excellent sensitivity, in-built vacuum tube voltmeter, strong steel case in attractive two-tone green finish.

Sensitivity 50 M.V./inch.
Three-step input att. ref. volts facility.
Wide Band Width 1.3 Mc/s (3 db down).
Time base to 90 Kc.
V.T.V.M. 5 ranges to 500 volts on centre zero meter.
H. 9¼" x W. 8¼ x L. 13".

Price only £85/10/. including Sales Tax.

STOP PRESS ANNOUNCEMENT!

JUST OUT

The New A & R

TRANSFORMER LEAFLET

Featuring

Latest Power Transformers

and

Hi-Fi Foundation Kits

ELECTRONIC A & R EQUIPMENT

A & R TRANSFORMERS

Approved for use in

MULLARD "2 STEREO 2" AMPLIFIER

Power Transformer PT1884

Output Transformer OT2558

NOW AVAILABLE
at your local A & R Distributor

VIC.: J. H. Magrath and Co. P/L., Homecrafts P/L., Radio Parts P/L., Warburton Franki, Motor Spares Ltd., Howard Electrical and Radio Co. SOUTH AUST.: Gerard and Goodman Ltd., 196 Rundle St., Adelaide. QLD.: A. E. Harrold, 123 Charlotte St., Brisbane. Chandler's P/L., Albert and Charlotte Sts., Brisbane. Trackson Bros., 157 Elizabeth St., Brisbane. WESTERN AUST.: A. J. Wyle P/L., 1064 Hay St., Perth. TAS.: Homecrafts P/L., 220 Elizabeth St., Hobart. N.S.W.: N.S.W. Factory Reps.: R. H. Cunningham P/L. 16 Angas St., Meadowbank. Available from all Leading Distributors.

in gain of 14 db by a very simple method.

Because the control operates at a very low impedance, and at a point of moderate gain, it would be quite practicable to wire this control to the end of an extension cord, as is sometimes done, so that balance can be observed from the best listening position. Some may find this possibility intriguing.

Note that the 2,500 ohm potentiometer is a linear type. A value of 10,000 ohms will allow a little more feedback and range of control but will crowd the useful operation nearer to the extreme settings of the control. A smaller value will give a finer control, but will reduce feedback and may provide unwanted coupling between the stages. This normally does not happen because the capacitor provides an earth point for the control for signal currents but not for DC potentials.

INPUT SWITCH

The input switching is quite simple. It provides the facility to reverse the stereo from one side to the other, a parallel position if you wish to play mono records that way, and a radio position in which both amplifiers are wired in parallel. We could even arrange a fifth position to parallel both input and output of the unit for use with a mono pick-up if you have the luxury of two types.

The stability of the preamplifier when connected to the 10-watt stereo amplifier —or the 17-watt for that matter—can be regarded as complete. The decoupling for the unit is already built into the amplifier, and there is no need for any more.

Adjusted for a sensitivity of 6 millivolts and with the extras bass boost turned full on, the output with the pick-up leads shorted contained very little hum, even with the gain control wide open. Nor was there any suggestion of motorboating under any conditions, and that is a very severe test.

The only substantial noise to be heard was valve hiss, and even that was not objectionable unless the treble boost was fully advanced. Hardly a realistic condition under which to listen to an amplifier playing no music!

EXTRA DECOUPLING

Should for some reason extra decoupling be thought desirable it would best be included in the lead which feeds high tension to the first pair of valves. A resistor of 15K and a 50 mfd tubular capacitor would probably represent the maximum effective filtering for the unit, and it is unlikely that under the worst conditions any residual hum will be audible.

With such a high sensitivity, it might be well to provide a variable centre tapped resistor across the filament winding in the amplifier which supplies the unit, and adjust it for minimum hum level. The earth return could also be made to the cathode of an output valve to place a positive bias upon it. These devices are sometimes useful when the lowest possible hum level is required.

Because there are four valves in the unit, the voltage dropping resistor in the amplifier (33K in the 10 and 17-watt amplifiers) should be reduced to 10K to deliver approximately 200 volts to the unit.

The unit operates well with any of the tuners already described as suitable for the Playmaster series, and connection will be automatic when the tuner is plugged into the socket at the rear.

The construction of the unit has also been the subject of much thought, but on the whole we could think of no better method than that used in previous Playmasters.

This is to divide the work as much as possible into prefabricated units which are bolted into place and interconnected with the fewest possible leads.

VALVE MOUNTING

As before, the valves are mounted on brackets fastened to the front panel. At each side of the sockets an eight-tag terminal strip is mounted and most of the components associated with the valves are mounted directly between the socket lugs and the strips, or on the strips themselves.

The rear tag strips carry connections to filaments and high tension so that external leads can be attached to them at the rear of the unit. In the case of the first bracket the input leads are also mounted on the rear strip quite close to the input connectors which are mounted on the back of the U-shaped section which forms the outer wall of the case.

Because a description in words becomes tedious and often involved, we have included some photographs of the wiring on the two brackets, with most of the wires and components lined in so that they will print out most clearly. In our next issue we may be able to include some drawings of these brackets to clarify the point together with a few further comments which will assist in building it.

COMPONENT MOUNTING

Another side view photograph of the unit is included which shows quite clearly most of the interconnecting leads, and with the aid of the circuit diagram you should not find it difficult to work them out.

In the case of the auxiliary bass and treble controls, the obvious method for mounting most of the small components is across the terminal lugs of the potentiometers. The 39K resistor leads run through holes drilled in the bracket mounted between them, and two more holes accommodate leads to the 560 pf capacitors. These are supported between the treble control pots and a three-lug tap strip bolted to the bracket near the holes through which the leads pass.

The leads from the switch to the grids of the second pair of valves also pass through holes drilled through the appropriate bracket. Use separate holes to keep the leads spaced apart from each other.

Note that there is no room for the cathode bypass capacitors on the underside of their bracket, so they are mounted on the opposite side, and leads run through two more holes through which they connect to the cathodes.

No earth connections are made to the front panel or to the covers on the pots. They are made to the nearest earth point on the tag strips so that all the earth currents are confined to the shortest paths.

This isn't a vital point, as there are no AC currents running through the metal work. The filaments are earthed in the amplifier itself, and not connected in any way to the unit metal work.

POWER CONNECTION

The power plug for connection to the amplifier and the 5-pin socket for the tuner are mounted side by side on the back of the U-piece with the tuner socket toward the outer edge. This makes easy bridging of heater, high tension and earth leads between the sockets. The leads from the octal power plug can run behind the rear edges of the brackets which are spaced with ¼ inch clearance from the U-piece.

The best way to build the unit is to assemble the brackets first, and then bolt them to the front panel. The controls are then mounted, and connected up to the brackets. The sockets are then mounted to the U-piece and interconnected, after which the U-piece is bolted to the panel and final connections made.

The side plates are bolted to the flanges of the U-piece after everything has been completed, and they carry ventilation louvres placed to clear the brackets. Self tapping or plain tapped bolts may be used.

All the bolts through the front panel are countersunk.

In the interests of low noise, the plate and screen resistors for the valves should be high stability types. The components in the compensation circuit of the first valves should be 5 per cent, although the remainder can be 10 per cent values.

The resistor across the input circuit will depend on the load specified for the pick-up you use, and it is not possible, therefore, to specify a fixed value.

The potentiometers should be specified as being matched to close tolerance as is normally done for stereo work.

The indicator light may be any suitable coloured bezel with a dial lamp mounted behind it. We used a socket of the type generally found on tuning dials, and bolted it to the panel, making sure that the bracket was insulated from both active lugs carrying the 6.3 volts AC.

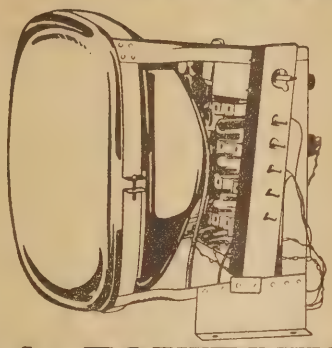
Plans for the metal work have been supplied to the metal workers, and it should be available by the time this issue is on sale. Next month we will include drawings in case you would like to make it yourself.

FRONT PANEL

Details of the engraved or printed front panel have been similarly supplied. If you don't like the different levels we used for the control knobs you can easily mount them in a straight line, but we didn't like the appearance of them that way.

The connecting lead to the amplifier should include two lengths of low capacity co-axial cable or microphone cable for the grid connections. Do not use ordinary shielded hook-up wire, as the capacitance is unduly high, and there will be some treble loss with the gain control in intermediate positions. Using cable, the loss at 10 Kc was negligible.

COMPLETE TV CHASSIS £119-16-8



A 21" side or front tuning, Astor parts.

B 6 diodes used where applicable.

C Fringe area set, 4—IF stages, 90 degrees short neck tube electrostatic focusing.

D Guarantee does not operate until the first telecast.

E Parts under guarantee replaced at your nearest capital city.

F Set complete—knobs, optical filter glass, speaker, mask etc.

P. A. EQUIPMENT

MAKE GREATER PROFITS — 15% BELOW COMPETITORS

A 6", 8" and 12" aluminium flares.
B Reflex flares.
C Sound columns cast aluminium.
D Sound columns "Slimline" up to 10 speakers.
E Amplifiers 5/10 Mullard.
F Amplifiers 20 ultra linear.
G Amplifiers 30 ultra linear.
H Other amplifiers 3W to 1000.

I Largest Suppliers of P.A. Equipment to Victorian Government.

MADISON T.V.

AUSTRALIAN SOUND & TELEVISION CO. PTY. LTD.

218 George Street, Fitzroy, Melbourne, VICTORIA
JA5795 or JA3828

I use the solder leading TV and radio manufacturers use

ERSIN Multicore 5 CORE SOLDER

PACKED IN A CONVENIENT DISPENSER PACK

I know Multicore. I know leading radio and television manufacturers in most countries of the world, including U.A.S. use it exclusively. For Multicore is the only solder with more than one core of flux built right into the solder itself. Multicore has five!

This is complete protection against dry joints . . . and as Multicore uses only virgin metals, every inch is top quality. I like the dispenser pack — the wire draws from the top without twisting or damage.

I like the fact that you use far less Multicore on every joint. Top quality, convenient, economical and now made right here in a modern Australian plant. What more could you want?

HOW TO USE MULTICORE

Apply Ersin Multicore Solder simultaneously with the iron or other means of heat to the clean components to be soldered. No additional flux is required. Only apply solder direct to the iron for tinning. Do not carry solder to the joint on the iron.

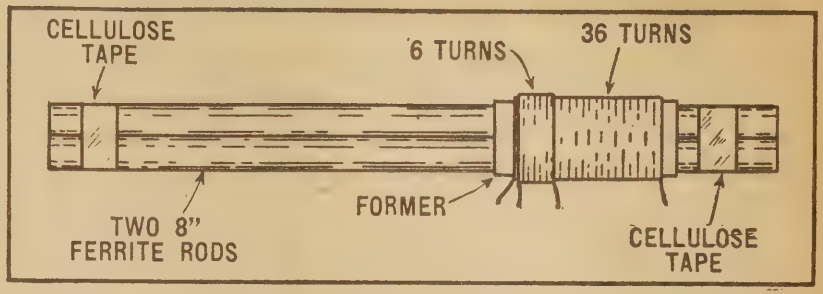
MULTICORE SOLDERS (AUST.) PTY. LIMITED
43-51 NELSON STREET, ANNANDALE, N.S.W. LA 3666

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

MORE STATIONS WITH YOUR "TRANSPORTA SIX"

At the cost of a little trouble and an extra ferrite rod it is possible to increase the pickup of a "loopstick" aerial. Our correspondent, Mr Dick Taylor, of Melbourne, describes the scheme in relation to the "Transporta Six" but there is no reason why it could not be used with the "Seven" for even better results.



Details of the dual rod aerial which our correspondent has found to be worthwhile in the case of the "Transporta Six" receiver. The original receiver was described in the August, 1958, issue and the "Transporta Seven" in the February, 1959, issue.

We quote Mr Taylor's letter.

Having constructed both the "Transrta Six" and "Seven" and tested themder similar conditions, I am in no ubt as to which is the better proposin for overall results. But a small modiation to the Six has made mine a se runner-up to the Seven.

When I first built the Six I found it ideal "city" set. Taken into the untry, a hundred miles or so from the arest national stations, it naturally gan to reveal its limits. The addition a short external aerial boosted signal ength considerably, but this measure s not always convenient when the set s required essentially for portable use. So I began to toy with the idea of creasing the gain from the internal fere-rod antenna. The problem was solved ry simply — and the outcome has en a remarkable improvement in lume. National stations now flood in ring the day at excellent strength, ile at night Queensland and W.A. tions can readily be added to the .

OUBLE BARRELLED SETUP

What I did was to construct a "doublerrelled" aerial setup. Two ferrite rods re strapped together with a couple of ces of cellulose tape and a new aerial il wound over both. The main windg consists of .36 turns of 26-gauge .c wire. (The number of turns will rhaps vary a little with individual sets). e "pick up" coil consists of six turns enamelled 28 gauge wire, wound dictly over one end of the larger coil.

A few comments on the construction the coil former may be helpful. I ade mine from a strip of manilla per, 9in x 1½in, cut from an ordinary siness envelope. Wrap one complete rn around the rods, then smear the rved surface with a little plastic ment. Wrap on a further turn of per, pressing it well against the gumed surface underneath to ensure good hesion. Continue this gumming and apping process until a neat, ovalaped former has been built up.

Make sure to put on each layer firmly, but allow the finished former to slide smoothly along the ferrite rods. (Avoid getting any of the adhesive on the rods). Allow the former to dry for a few hours and it will become firm and hard.

The only item that may call for a little ingenuity is the construction of a suitable bracket for the "double-barrelled" assembly. I surmounted this difficulty by enlarging the slots of the existing bracket into a convenient elliptical shape. Over-size rubber grommets were forced into these new slots and the ferrite rods pushed through them.

My next experiment is to try three ferrite rods together. But maybe this is being TOO greedy.

EARNED MONEY TO PAY FOR HI-FI

How to pay for radio equipment, particularly hi-fi, is the problem which faces many of our younger readers. One of them from Brisbane tells how he has managed to do so in his contribution to this page which, incidentally, will add a further few shillings to his account.

MY submission is a short essay on fund-raising for students. Using the following methods I have been able to pay for my "hi-fi" radiogram. This includes an "ultralinear" output transformer.

Lawnmowing is one of the best. Just walk round a suburb on a Saturday or Sunday afternoon. There's bound to be someone mowing the lawn, puffing and panting as he goes.

Observe how much is yet to be done and how tired the poor chap is. Then, over the fence say, "Tell you what, sir, (include sir always)—I'll finish it for ten bob." If there's a lot to do suggest 15/, if there's little, 5/. I found that about every second person took me on. I averaged 25/ per afternoon.

Another job I had was doing odd jobs in the local grocer's. He paid 5/ an hour to sweep the floor, put empty bottles into cases, put new stock on shelves, etc. I did half an hour each weekday and 2 hours on Saturday mornings. Total payment £1 per week —very handy.

The easiest-earned money I received was for compering a Teenage Hit Parade on a Brisbane commercial radio station (4BK). In six weeks I got £15/10/. (I did about 1 hour's "work" each week.) Such engagements are not easily come by but are well worth a try.

These jobs are essentially spare-time, but many firms take on extra staff around Christmas time. These are generally full-time and pay well. One can become a shop assistant, cleaner or do odd jobs in a factory.

I worked in an icecream factory last year and earned £50 in 5 weeks. This was possible because of overtime loadings. (My age, 17.)

These thoughts may help some keen but broke schoolboy who wants to complete some project in radio (or any other expensive hobby).

(P.S. Cost can be kept down by using second-hand parts (not fixed capacitors) bought at the various disposals stores and radio junk shops found in all capitals and most large towns.)

Hoping that you consider the above ideas publishable. (Is there such a word?)

Yours sincerely,
David K. C. Snowden.

PHILIPS STEREO

Record Changers and Record Players

TYPE NG1020

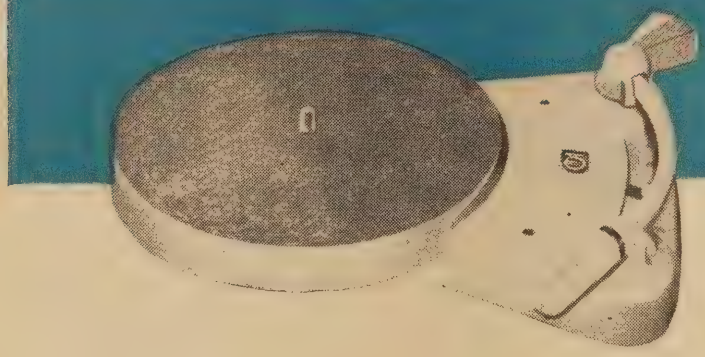
Triple-Function STEREO Record Changer

Now produced specifically for stereo operation, the popular Philips push-button record changer fulfils the exacting demands of this exciting new development in record reproduction.

- Two separate plug-in high-fidelity pick-up heads: LP and Stereo type AG 3063; 78 r.p.m. type AG 3066.
- Plays all types and sizes of records—Stereo, L.P., 78, 45, 33⅓, 16⅔.
- Push-buttons for easy operation.
- Three separate functions.
1. Fully automatic changer—loads up to ten records.
2. Automatic single play. Single records may be placed directly on the turntable.
3. Manual single play.

- Smooth, silent, rumble, wow and flutter free.

PHILIPS



TYPE NG1009

A.C. Player with Stereo Counterweight and Stereo Pick-up Head

NG1009—A.C. player with standard twin stylus pick-up head **£10-9-0**

AG3063—Stereo pick-up head **£2-7-6**

NG1023—Stereo counterweight **10-6**

Mounting plate **15-6**

NG1012—6-volt battery-operated version of record player **£13-5-0**

A pick-up arm counterweight is now available as an accessory for the popular Philips four-speed record player. With the stereo pick-up head plugged in, the counterweight reduces the needle pressure to the correct amount for playing stereo recordings. This removes the need to use inaccurate spring devices and the unit provides a compact stereo player for the widest applications.

P1521-59

PHILIPS ELECTRICAL INDUSTRIES PTY. LTD.

Sydney • Melbourne • Brisbane • Adelaide • Perth • Hobart

This fine picture gives an idea of the telescope's size. The bowl is 250ft in diameter and the telescope weighs 2,000 tons.

How Radio Telescope Is Used

The world's largest radio telescope at Jodrell Bank near Manchester has already contributed greatly to the knowledge of outer space, and has also provided invaluable assistance in tracking the man-made satellites since it came into operation. But this article tells how it is controlled by special computer equipment.

By

J. Stubbs Walker

Science Correspondent of the "Sunday Graphic," London

THE towering structural splendour of Manchester University's radio telescope at Jodrell Bank, England, which, in its first months of operation, earned an international reputation in satellite tracking, has to some extent obscured the remarkable electronic engineering achievement in the precisely controlled movement of the 2,000-ton rotating aerial.

To appreciate this it is necessary to realise the really great size of the Jodrell Bank equipment. The parabolic reflecting bowl, a "dish" of steel plates 250 feet (76.2 metres) in diameter and weighing nearly 800 tons, can be tilted to any angle to control the elevation of shoot of the aerial. It can even be turned upside down, an operation necessary to change the aerial.

The paraboloid is pivoted between two steel towers rising 180 feet (55 metres) from a system of deep trussed girders not unlike railway bridges. All this array of steel, massive but with quite an elegant lignity, is supported on bogies travelling on a circular railway track 352 feet (107.29 metres) in diameter allowing the structure to be steered in azimuth. The impressive 2,000 tons of hardware can thus be rotated and the bowl can be rocked to aim the aerial at an accuracy in each co-ordinate of better than 12 minutes of arc. That figure is the required accuracy, but in fact in reasonable weather conditions an accuracy of three or four minutes of arc can be assumed.

Initially it had been planned to make the reflector of wire mesh stretched over a system of tangential supporting members which would have given a deviation from the true paraboloid of several inches. At short wavelengths—in the region of one metre—an error of this magnitude would have resulted in considerable loss of signal, so it was decided to change the design and to form the bowl of individually shaped and welded steel plates. This, of course, made a big difference to the weight and windage of the bowl and necessitated a major redesign of some parts of the structure.

THE ELECTRONIC PROBLEM

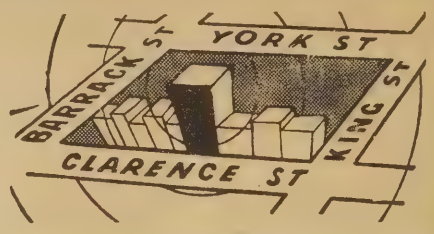
The electronic problem was to provide a driving system sufficiently powerful to move the telescope in azimuth and elevation under all but the most severe wind conditions and to provide a method of controlling this driving source so that the telescope could automatically follow any point in space irrespective of the rotation of the earth and its movement round the sun. Two identical closed loop servo mechanisms are in use which must each control four variable speed direct current motors of 50 horsepower each, the speed range being 10 to 1,000 revolutions per minute by Ward Leonard voltage control, with an additional speed range of from 1,000 to 1,500 r.p.m. obtained by weakening the motor field.

The co-ordinated movement in azimuth (about a vertical axis) and elevation (about a horizontal axis) is controlled by signals from an analogue computer. The small signals from the computer require amplification at ratios up to 30,000,000 to 1, achieved in the main by direct-coupled amplifiers.

Obviously the design and development of the control machinery at Jodrell Bank

GENERAL ACCESSORIES

PTY. LTD.
(FORMERLY HOMECRAFTS PTY. LTD.)
100 Clarence Street, Sydney
Phone BX 4451



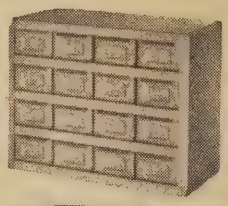
HANDY CABINETS

A craftsman built unit attractively painted in pearly grey baked enamel with provision for fitting identificaton card on each drawer. A strong and most useful cabinet for holding small parts or tools, ideal for mechanic, engineer, garage, store-keeper or home workshop. Provision is made for stacking and all units will interstack.

Available in the following Models Packed in a Strong Carton.

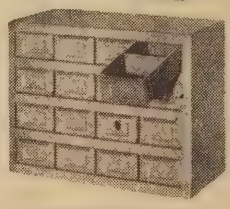
MODEL A

Cabinet 12" x 9" x 5½". 16 drawers 5½" x 2⅝" x 1½".



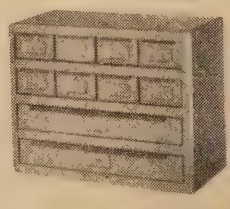
MODEL H

As Model A — but fitted with Divisions.



MODEL D

Cabinet 12" x 9" x 5½". 8 drawers 5½" x 2⅝" x 1½". 2 drawers 11" x 5½" x 1½".



CRYSTAL SET BUILDERS

Single Gang Condensers	1 guinea
Q plus Headphones	£2/1/-
Spring Terminals	1/2 ea.
Germanium Diodes	
OA70—OA73	6/1 ea.
OA81-OA85	7/1 ea.
Jabel Crystal Coil	8/6 ea.
Aerial Wire (100ft)	14/9 ea.
Insulators	1/ ea.
Boys' Book of Crystal Sets	5/ ea.

MANUALS

Radio Servicing No. 1	7/6
Radio Servicing No. 2	7/6
Radio Servicing No. 3	7/6
Fault Finding	7/6
Magnetic Recording, Wire and Tape	7/6
Transistor and Crystal Diodes	7/6
The Oscilloscope Book	7/6
Television Servicing No. 1	7/6
Television Servicing No. 2	7/6
Television Servicing No. 3	7/6

PHILIPS VALVE DATA BOOK NEW ISSUE
18/6 plus 2/1 postage

SCOPE

SOLDERING IRONS 6 sec.

Standard	£2/10/-
Instrument	£2/10/-
Vibroscope	£1/15/-
Transformers	£2/10/6

GLEN RADIO AC/DC INVERTERS

50 watt inverters:
12, 24, 50, 32, 110, 230v Dc input
230v 50 cycles AC output— £22/9/6

100 watt inverters:
12, 24, 32, 50, 110, 230v DC input
230v 50 cycles, AC output £33/2/6

150 watt inverters:
12, 24, 32, 50, 110, 230v DC input
230v 50 cycles AC output £37/1/3

STEREO EQUIPMENT

B.S.R. 4-Speed Record Changer, UA 8/Stereo	£22
B.S.R. Record Player HF.8/ Stereo	£16/16/-
Golding Lenco Transcription Motor GE.56	£30
Goldring Pickup Arm G.60	£8/10/-
Twin Ten Stereo Chassis	£2/10/-
Loudspeakers—	
8MX	£4/10/-
12MX	£6/16/6
12OX	£11/4/-
12UX Hi Fi	£28/19/6

Write for your booklet on Vented Enclosures for Rola Loudspeakers.

TRANSISTOR SET BUILDERS

Ducon Ferrite Rings	10/6
Transporta Chassis	£1/7/-
Three Transistor Mantel Chassis	17/6
Miniature Rola Transformer.	
TR27	£1/2/3
DR27	£1/5/-
Rola 2C Speakers	£1/18/6
26 gauge B. and S. Wire, 4oz reel	9/-
Matrix Board—	
12in—9-hole	10/1
12in 6-hole	9/1
6in 9-hole	4/11
3in 9-hole	2/6

Screw-type hole cutters

Complete with wrench

7/8" 7 pin	£1/9/-
¾" 9 pin	£1/15/-
1⅛" Octal	£2/18/-

GENERAL ACCESSORIES PTY. LTD. FAST DESPATCH SERVICE

The control desk showing the galactic computer, phase selector and servo motor control.

was a major task. Requirements were set by the Manchester University staff, under Professor A. C. B. Lovell, and the resulting instrumentation, involving new techniques in electronic and mechanical engineering, was the responsibility of a rather remarkable man, Mr. Herman Lindars, who is not only the managing director of the firm that carried out the work, Dunford and Elliott (Sheffield) Ltd., but is also a musician of such consequence that he has on several occasions conducted the world-famous Halle Orchestra. The Brush Electrical Engineering Company Ltd. was responsible for the manufacture of the machines, motor control gear and reduction gear providing the physical motive power for the telescope.

BASIC FACILITIES

The remote control of the telescope gives it these basic facilities:

(1) It can be locked in any given azimuth and elevation.

(2) It is capable of continuous motion in azimuth with fixed elevation; or in elevation with fixed azimuth, at any required rate.

(3) By co-ordinating azimuth, elevation and time the telescope can be given sidereal motion for following any particular star.

(4) It can be set on a predetermined program of search in which it can be left to sweep methodically a given area of the sky.

The computer controlling the electronic-mechanical "engines" which give movement to the telescope is a complex one. While the telescope is capable of movement in only two basic co-ordinates, to follow a star it is necessary to set up the control in its fixed co-ordinates—right ascension and declination—and the computer must be capable of translating these into the physical voltage changes that control the driving motors. A slightly different requirement may call for the telescope to scan across or along the Milky Way, which would entail employing another set of co-ordinates, galactic latitude and longitude. Again it is sometimes necessary to scan in azimuth and elevation and at the same time to read off the positions either in right ascension and declination or in galactic latitude and longitude—or both. The computer, therefore, must be capable of solving, instantaneously and continuously, fundamental equations of spherical trigonometry.

The computer consists of an electrical analogue in which magslip resolvers solve the equations by giving output signals proportional to the sine and cosine of the angle through which their rotors are turned. Excitation of the stator windings is given through feedback amplifiers deriving the feedback voltage from auxiliary stator windings. High-gain, two-stage R.C.-coupled amplifiers obviate non-linearity in output due to electrical losses and unwanted flux.

Here is an example of the kind of computation required to arrive at the elevation (E) from known quantities of latitude of the station (L), declination (D), and (H) which is the hour angle or difference between right ascension and sidereal time. The equation can be written:

$\sin E = \sin L, \sin D + \cos L, \cos D, \cos H.$

The three known terms are derived from resolvers and combined to provide an "error" signal given by:

A rear view of the Azimuth co-ordinate panel part of the operating equipment. Here are four resolver amplifiers, servo amplifiers and servo motor.

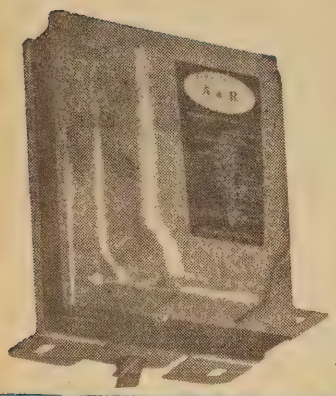
THE COMPLETE NEW RANGE . . .

ELECTRONIC A & R EQUIPMENT

POWER TRANSFORMERS

POPULARLY PRICED . . . FULLY GUARANTEED!

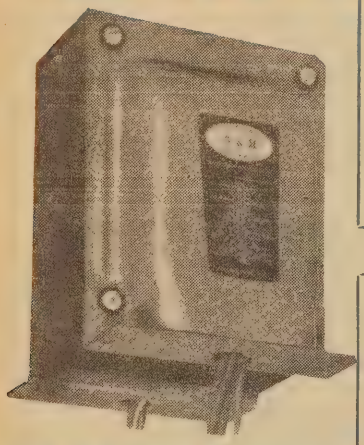
Matched to the A. & R. Audio Range



VLN 34 Mounting 60-125 mA

● Latest Vertical Cover Styling with simplified chassis mounting. ● Finished in durable Silver-Grey baked Enamel. ● Contrasting Black Cores. ● Permanent colour code affixed. ● Tapped Primaries 6.3V Rectifier Heater winding with 5V Tap. ● Full rated voltages all windings. ● Varnish impregnated. ● Leads anchored securely ● Low temperature rise.

Type	D.C.mA	Primary Volts	Sec. Volts per Side	Filaments
PT1880	60	0-230-240	250	6.3V-1A Tap at 5V-2A; 6.3V-2A
PT1881	60	" " "	285	6.3V-1A Tap at 5V-2A; 6.3V-2A
PT1882	60	" " "	325	6.3V-1A Tap at 5V-2A; 6.3V-2A
PT1883	60	" " "	385	5V-2A; 6.3V-2A.
PT1884	80	" " "	250	6.3V-1A Tap at 5V-2A; 6.3V-2A 6.3V-CT-2A.
T1885	80	" " "	285	6.3V-1A Tap at 5V-2A; 6.3V-2A; 6.3V-CT-2A.
PT1886	80	" " "	300	6.3V-1A Tap at 5V-2A. 6.3V-CT-2A; 6.3V-CT-2A.
PT1887	80	" " "	325	6.3V-1A Tap at 5V-2A. 6.3V-2A; 6.3V-CT-2A.
PT1888	80	" " "	385	5V-2A; 6.3V-2A; 6.3V-CT-2A.
PT1889	100	" " "	285	6.3V-1A Tap at 5V-2A; 6.3V-2A; 6.3V-CT-2A.
PT1890	100	" " "	300	6.3v-A Tap at 5V-2A; 6.3-CT-2A. 6.3V-CT-2A.
PT1891	100	" " "	325	6.3V-1A Tap at 5V-2A. 6.3V-2A; 6.3V-CT-2A.
PT1892	100	" " "	385	5V-2A; 6.3V-2A; 6.3V-CT-2A
PT1893	125	" " "	285	6.3V-1A Tap at 5V-2A. 6.3V-2A; 6.3V-CT-2A.
PT1894	125	" " "	300	6.3V-1A Tap at 5V-2A; 6.3V-CT-2A 6.3V-CT-2A
PT1895	125	" " "	325	6.3V-1A Tap at 5V-2A. 6.3V-2A; 6.3V-CT-2A.



VLN 38 Mounting 125-200mA

Type	D.C.mA	Primary Volts	Sec. Volts per Side	Filaments
PT 1927	125	0,230-240	385	V. 2A 6.3V 2A. 6.3V. C.T. 2A.
PT 1928	150	" " "	285	6.3V. 1A. Tap at 5V.2A. 6.3V.2A. 6.3V. C.T. 2A.
PT 1929	150	" " "	325	6.3V. 1A. Tap at 5V.2A 6.3V.2A., 6.3V. C.T. 2A.
PT 1930	150	" " "	350	6.3V 1A. Tap at 5V.2A. 6.3V.2A., 6.3V C.T. 2A.
PT 1931	150	" " "	385	5V 3A 6.3V 3A., 6.3V. C.T. 3A
PT 1932	175	" " "	285	5V 3A 6.3V. 3A., 6.3V. C.T. 3A
PT 1933	175	" " "	325	5V 3A 6.3V. 3A., 6.3V. C.T. 3A
PT 1934	175	" " "	350	5V 3A. 6.3V. 3A., 6.3V. C.T. 3A
PT 1935	175	" " "	385	5V 3A 6.3V. 3A., 6.3V. C.T. 3A
PT 1936	200	" " "	285	5V 3A. 6.3V. 3A., 6.3V. C.T. 3A
PT 1937	200	" " "	300	5V. 2A. 6.3V. 3A., 6.3V.3.5A.
PT 1938	200	" " "	350	5V 3A. 6.3V. 3A., 6.3V. C.T. 3A
PT 1939	200	" " "	450	5V 3A. 6.3V. 3A., 6.3V. C.T. 3A

ELECTRONIC A & R EQUIPMENT

DISTRIBUTORS

A. & R. ELECTRONIC EQUIPMENT CO. PTY. LTD.

378 ST. KILDA ROAD, MELBOURNE. MX1150

VIC.: J. H. Magrath and Co. P/L., Radio Parts P/L., Homecrafts P/L., Motor Spares Ltd. Warburton Franki Ltd., Howard Electrical and Radio Co. SOUTH AUST.: Gerard and Goodman, 196 Rundle St., Adelaide. QLD.: A. E. Harrold P/L., 123 Charlotte St., Brisbane. Chandlers P/L., Albert and Charlotte Sts., Brisbane. Trackson Bros. P/L., 157 Elizabeth St., Brisbane. WESTERN AUST.: A. J. Wyle P/L., 1064 Hay St., Perth. TAS.: Homecrafts P/L., 220 Elizabeth St., Hobart. N.S.W. Factory Reps.: R. H. Cunningham P/L., 16 Angas St., Meadowbank. Available from all Leading Sydney Distributors.

F = sin E — sin L, sin D — cos L, os D, cos H.

The error signal is fed to an R.C.-oupled amplifier with phase sensitive ectification (whose output drives a D.C. notor generator (via a D.C. amplifier ncorporating feedback control, to which s coupled the E magslip in such a sense hat a positive value of F drives E owards zero.

There is no single equation that can e used with sufficient accuracy of con-rol over all parts of the sky. This is vercome by using 14 different equations n the computer. Cams on the shafts of he resolvers automatically switch in the ppropriate equations according to the osition in the sky of the target. Seven f these equations are used for calcu-ating azimuth and elevation from hour ngle and declination (and the other way ound) and another seven calculate lati-ude and longitude from right ascension nd declination. A block diagram Figure 5) shows the arrangement for électing the first of the two groups of even equations.

CORRECTING PARALLAX

An additional elevation resolver, set y a calibrated potentiometer on the ontrol desk, is used to correct for paral-ax error arising when a body near the arth, such as the moon, is observed. The equations for distant targets are omputed on the assumption that the iewer is at the centre of the earth, vhile, of course, the telescope is mounted t the earth's periphery. Parallax cor-ection is therefore needed when work-ng, as it were, in "close up."

A major control problem is that vhereas the position of the stars in right scension and declination remains, to all ntents and purposes, constant, the posi-ons of the sun, moon and the planets not to mention the satellites) are con-antly changing. When these are being bserved it is necessary to apply cor-ections in right ascension and declina-on. These are set up on the control esk, causing motors coupled through ifferential gears to the computing echanisms to pass on the corrections in econds of time per hour (for right scension) and in seconds of arc for eclination.

To enable the controller to be cer-ain that the position of the computer-ontrolled shafts determining azimuth nd elevation of the telescope coincides ccurately with the physical position of he aerial itself, course and fine mag-ip transmitters are connected to coin-idence transmitters driven by the tele-cope. The output of the coincidence ransmitters is proportional to the error etween the required position and the ctual position, and it is fed to servo-mplifiers that move the telescope driv-ng motors in such a sense as to bring he error signal to zero.

When the telescope is required to scan given area a "target arc" is selected. As each lateral sweep is completed a ulse can be provided to depress or ele-ate the arc of scan by a given amount, o that a scanning raster is built up, aintly similar to the technique of tele-ision scanning, except that each suc-essive line is swept in the opposite di-ection to that of the former. The aster can be arranged in vertical or hori-ontal scan and is capable of fully au-omatic control. The co-ordinates of the can can be coupled to a time control hat will shift the complete raster in ac-ordance with sidereal time.

In all movements of the telescope, indicator dials show at the control desk the position in which the aerial is firing. The dials indicate degrees and minutes of arc, and hours, minutes and seconds of time. Others show sidereal time, universal time, and the repeated-back positions in azimuth and elevation of the telescope itself. This information is given with an accuracy of better than one minute of arc.

Sidereal time is obtained by a synchronous motor, which is controlled by a regenerative oscillator driving through a power amplifier. The speed of this motor is compared every 30 seconds with a pendulum-driven master clock and is arranged to drive very slightly faster than the required sidereal time would call for. If at the time of a 30-second check the motor-driven clock is in advance of the master clock, a capacitor is switched across the input to V.1, thus reducing the oscillator frequency and slowing the speed of the sidereal motor to bring the clocks back into coincidence.

HEIGHT RECORD FOR MODEL PLANE

(Continued from Page 9)

150ft in something over two minutes.

By this time the plane was flying over mountain country where it almost certainly had to contend with local turbulence. For the radar unit, tracking had become extremely difficult, and there were no further readings because of the extreme range and the cloud conditions in the areas into which the plane had been carried.

As the plane still had considerable fuel it seems likely that it may have reached an altitude of about 16,000ft. No one knows its eventual altitude, however, and even if the plane is recovered at some time the riddle will remain since it was not carrying a barograph.

STRONG JOINTS IN FINE WIRES

PRECISION brazing equipment for the hard soldering of fine wires—down to a diameter of 0.001in and less—was on view at the Radio and Electric Component Show in London recently.

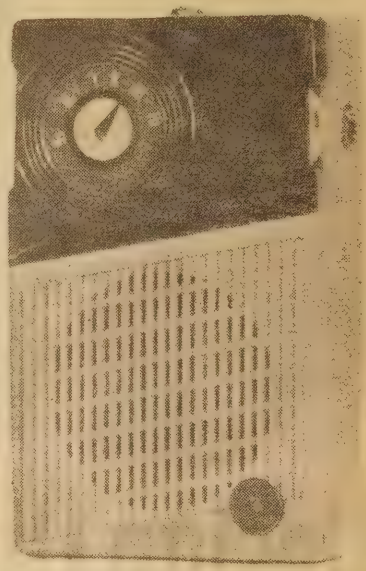
The compact portable unit, designed for use with silver brazing alloys having melting points up to 800 deg. C., incorporates an electrical heating element. A sliver of solder rests on the element. The wire ends are held in position on the solder which, on heating, amalgamates with the metallic surfaces to give a strong bond. The temperature of the element is adjustable and can be so controlled as to prevent overheating of the wire.s

The instrument is provided with receptacles to contain the flux, a material like borax which cleans the metallic surface and makes it receptive to the solder, and solutions for flux removal, the solutions being heated. It will work off any a.c. supply from 200 to 250 volts.

The makers, are themselves employing this type of equipment in certain manufacturing processes, especially for hard soldering resistance wires, such as nickel-chrome and related alloys, where soft solder is either difficult to use or has too low a melting point for the particular job, and where spot welding gives too weak a joint. Cost is £45 and the price of a pack of 12 elements is 18/.

"AIWA"

4 TRANSISTOR POCKET RADIO



Operates for several months from a local battery which costs only 12/1. Supplied with miniature type earpiece and when this is plugged in the loudspeaker is automatically disconnected.

Price £19/17/6 cash.

Posted £20/-/-.

Spare batteries always available. Illustration approx. half size.

"HANSEN T.S." TV MULTIMETER

with 17.5K probe
10K per volt D.C.
4.5K per volt A.C.
Tolerance + − .5%

£14/3/9

Radio House Pty. Ltd.

296 PITT STREET, SYDNEY

Branches at 6 Royal Arcade and 760 George Street.

Our own experimental instrument housed in a standard small instrument case. When the "law" of the meter circuit is finally established we will arrange for proper scale to replace the standard "0-100" version shown. Function of the controls should be self explanatory.

Design Of Distortion Meters For Audio

One of the major problems facing the amplifier enthusiast is that of assessing the performance of his equipment. In this article we discuss some of the aspects of distortion measurement and, in particular, types of distortion meters which are within the range of the average home constructor.

SINCE very few individuals can afford or justify the cost of laboratory type instruments, amplifiers are seldom tested beyond the most elementary stages. This may include a power output check, possibly a frequency response run, and even a check of the waveform on a CRO but, after that, what can we say about the amplifier's performance?

Assuming we achieve the designer's estimated power output, a level response, and a waveform which looks good on the CRO, we probably feel pretty confident that the amplifier is working as well as the designer intended. But we never can be sure that there is not more distortion in the output than we would like, due either to poor design or an error in a component. After all, how many of us can pick one, two or three per cent distortion simply by studying the pattern on a CRO?

If we are perfectly honest we will admit that very few can; yet modern standards suggest that our amplifiers should achieve fractional percentages of distortion and anyone who suggested that our favourite amplifier might have two or three per cent would be very unpopular indeed.

While it is true that modern amplifier designs reach a very high standard and, if carefully built, should perform every bit as well as the original, there is always the odd case where an unsuspected faulty component can upset the best laid plans. And by its very nature, of course, such a defect probably will go undetected except that it may cause the builder to be vaguely dissatisfied with the performance.

by Philip Watson

Even more important is the case whe the original design has had to be chan ed, possibly for some very good reaso and doubt arises as to whether it st is as good as the original. Or where a old amplifier, long cherished by the ow ner, needs to be compared with mo modern designs to determine whether r building can be justified. These, ar many similar situations, all call for som means of being able to measure disto tion, at least with reasonable accurac

USEFUL INFORMATION

While a check on the total distortio content of an amplifier is by no mean the whole story, it does provide an ex tremely valuable additional item of in formation. Taken in conjunction wit response curves, square wave checks, c whatever other data we can compile, does enable us to assess the overall per formance with a great deal more ac curacy.

With the idea of presenting a disto tion meter within the financial and tech nical scope of the ordinary audio en thusiast, we have been investigating vari ous circuits and methods which hav been suggested from time to time, an trying out the most attractive ones o the bench.

We have finally arrived at a desig which looks extremely promising, and w will have more to say about this late on. In the meantime, we felt that a survey of some of the suggested scheme would make interesting reading for those who like to know the "why" as well as the "how."

In very broad terms, distortion meters work on the principle of completely removing the fundamental frequency from the signal under test, then measuring what is left and comparing it in terms of percentage with the original signal. The result is—or should be—the total harmonic distortion in the signal.

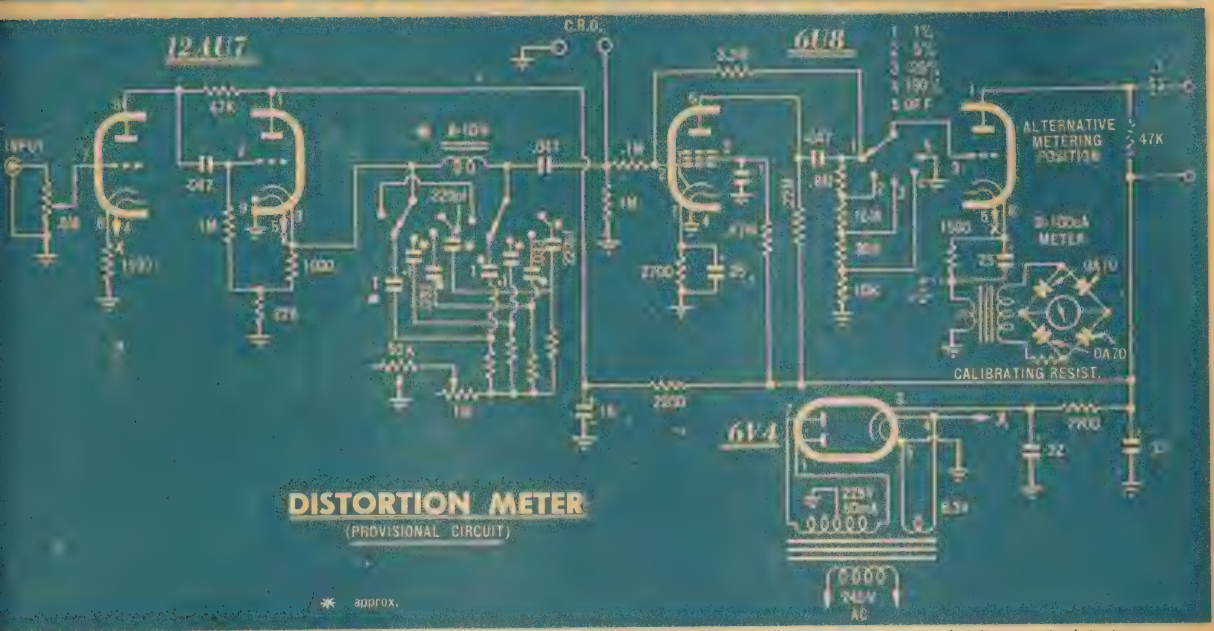
While a much simplified explanation, this principle is basically sound, and it then becomes a matter of deciding what is the best method of removing the fundamental.

In general, two basic methods appear to have been developed over the years.

The first is a cancellation system whereby the signal from the amplifier under test is mixed with the original generator signal in such phase as to cancel completely all the original signal, leaving only those products created by the amplifier.

Adherents of this scheme claim that

CIRCUIT OF A PRACTICAL DISTORTION METER



The circuit of the complete distortion meter, as we have developed it at the time of writing. It is a perfectly practical instrument, having a high sensitivity and capable of reading fractional percentages. However, some of the special components are not marked, as suitable commercial versions have yet to be made available.

s major advantage is that a perfectly ire signal from the generator is not ssential, since this will be cancelled hatever its form, leaving only the dis- rtion for measurement.

The second method is to attenuate ie fundamental by means of a tuned cir- uit. This arrangement makes no claim) being able to discriminate between istortion in the generator and that in the mplifier, so that the limitations impos-) by its use are largely those of the enerator. However, it has a number of seful advantages; not the least being iat it can be made up in an extremely mple form, but which still can be very seful in certain limited applications.

CANCELLATION SYSTEM

We spent some time investigating the ancellation system, and even went so ar as to build a prototype, but we were ventually forced to the conclusion that ie scheme was not nearly as attractive s it appears at first.

One point we queried right from the tart was the claim that generator dis- rtion was of no consequence, because ll the original signal would be can- elled. This could be so only if the mplifier under test was completely free rom phase rotation at all frequencies.

This might be true of the highest- uality basic amplifiers but it would ertainly not be so of less expensive ypes, control units or any section of an mplifier which contained provision for requency compensation.

In fact, this system invariably makes rovision for varying the phase of the enerator as it is fed into the mixing cir- uit, in order to cope with whatever hase changes occur in the amplifier. urther, since such phase shift networks nvariably are frequency-conscious and rovide the required degree of shift at ne frequency only, it is impossible to alance out more than the fundamental and—possibly—some of the harmonics from the generaator.

This limitation may not have been a serious one in itself—provided it was recognised—but other problems present- ed themselves when we came to build a practical instrument.

The most serious one also involved the matter of phase shift, the difficulty now being to provide the right order of shift for the generator reference signal fed to the mixer circuit.

The suggested circuits provided for a 180-degree phase shift by means of a centre-tapped transformer and a change- over switch, and for a 90-degree con- tinuously variable shift by means of a fixed capacitor/variable resistor network. Unfortunately, the continuously variable shift network can only work up to— or almost up to—the "zero shift" con- dition from each side (depending on the switch setting) but cannot be adjusted "through zero."

As a result, it becomes virtually im- possible to test an amplifier which has zero phase shift at the frequency in- volved, and still is difficult even when there is only a small amount of shift. Maybe modern amplifiers are better than is commonly imagined, but we found cases where this was a very real prob- lem around the middle frequencies. (What happens at higher or lower fre- quencies is another matter.)

We tried a number of other schemes to try to provide the required order of phase shift, only to be forced to the conclusion that there appears to be no easy solution to the problem. Very largely for this reason we were forced to abandon the scheme.

The only comfort is that, in tracking down as many references to this system as we could, we were made to realise that overseas workers had encountered exactly the same problems that we had, but had tended to sidestep them or treat them as less important than we feel is justified.

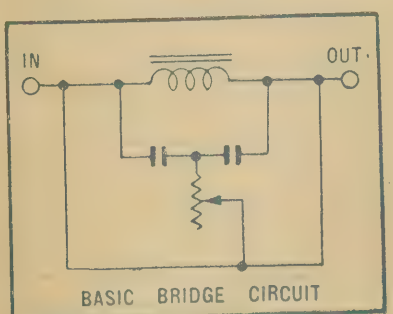


Fig. 1—The basic "bridge—T" net- work, used to completely suppress the fundamental, so that harmonics may be observed.

TUNED CIRCUITS

Abandoning this line of attack we turned our attention to the tuned circuit system. There are several possible schemes, such as the Wein Bridge net- work, the "double bridge T" (resistance capacitance network), and the more popular "bridge T" employing induc- tance and capacitance.

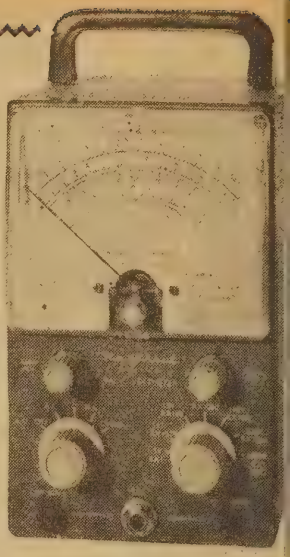
Both the Wein bridge and the resis- tive bridge T appear to suffer from the same defect, i.e., while it is possible to make the attenuation virtually complete at the chosen frequency, it is difficult to avoid attenuating some of the har- monics as well. Further, this effect may vary at different frequencies.

(It is possible to compensate for this effect, at least in the resistive bridge T, by following the circuit with an equali- sing filter. This appears to be an attrac- tive idea and we may investigate it more fully at some later date. One further possible objection would appear to be

BUILD YOUR OWN VTVM *with...*

FAMOUS AMERICAN

HEATHKIT V-7A



SPECIFICATIONS:

D.C. Volts. 7 ranges 0-1.5 to 0-1500.
Input Resistance 11 megohms
Sensitivity 7,333,333 ohms per volt on 1.5V range.
Accuracy plus or minus 3 per cent full scale.

A.C. Volts. 7 R.M.S. Ranges 0-1.5 to 0-1500.
Frequency Response (5V Range) plus or minus 1 D.B.42 C.P.S. to 7.2 MC.
Accuracy plus or minus 5 per cent full scale.
7 peak to peak Ranges 0-4 to 0-4000.
Resistance — 7 ranges — measures .1 ohms to 1000 megohms with internal battery.

CONSTRUCTION IS SIMPLE, ENJOYABLE — SUCCESS GUARANTEED

- **INFORMATION-PACKED CONSTRUCTION MANUAL.** Everything you need to know is contained in this clearly written text. It has been specially designed to take you through every phase of assembly with ease, even though you may be a complete newcomer to electronics.
- **EXPLANATION OF PROPER SOLDERING PROCEDURE.** Instructions begin at the very beginning, and even illustrate and describe the proper procedure for making good solder connections. You can't go wrong if you follow the directions.
- **STEP-BY-STEP ASSEMBLY INSTRUCTIONS.** Read the step . . . perform the operation . . . and check it off — it's just that simple! These plainly-worded, easy-to-follow steps cover every assembly operation, and let you rely on our experience in kit construction.

- **EASY TO FOLLOW PICTORIAL DIAGRAMS**

You'll get plenty of these detailed p torial diagrams in your Heathkit co struction manual to show where ea and every wire and part is to placed Everything you do is spell out in pictures, so you can't miss.

PRICE: £27/10/- + 12½% S.T.
(Post Vic., 2/9; Int., 6/-)

EASIEST TERMS
£6/18/9 DEP. & 45/- MTHLY. for 12 mths.

WARBURTON FRANKI

359 LONSDALE ST., MELB.—MU835

TAPE RECORDER AND RADIO COMBINED!

ELCON RadioCorder

The ELCON Radio Corder (radio and tape recorder combination) is the greatest recorder bargain ever, featuring dual track recording, two-speed operation, up to two hours playing or recording time as well as a six-valve, built-in radio.

ELCON IS USED EVERYWHERE
• IN INDUSTRY • IN COMMERCE • CLUBS and SOCIALS
• AT THE OFFICE • FOR THE BLIND • IN THE HOME
• FOR EDUCATION • FOR THE MUSICIAN

Distributors: VIC.: Vealls Electrical and Radio Pty. Ltd. 490 Elizabeth St., Melbourne, C.1. FJ 0456 Admiralty Distributors, 76 Bridge Rd., Richmond. JA 3416 **N.S.W.** James Balfour & Co. Pty. Ltd., 13 Market St., Sydney BX 5861. **S. AUST.:** James Balfour & Co. Pty. Ltd., 169 Morphett St., Adelaide. LA 2444. **QLD.:** James Balfour & Co Pty. Ltd., 118 Stanley St., Brisbane. J 2484 **W. AUST.:** James Balfour & Co. Pty. Ltd., 297 Wellington St., Perth. BA 2444. **TAS.:** Admiralty Distributors 75 Bridge Rd., Richmond, E.1, Vic

£155/10/-
WITH RADIO
£124
STANDARD
Attractive colour scheme; two tone green exterior with grey top.

OPTIONAL ACCESSORIES:
Extension speaker for quality sound reproduction. Foot switch for office dictation purposes. Headphones for use by typists, stenographers, etc Suitable for use with many types of microphones.

Available at all good music and radio stores, or ask the distributors in your State to send further information.

VL31

CUT OUT AND MAIL TODAY!

Please send me particulars of the New Elcon Radio Corder and Standard Tape Recorder

NAME.....

ADDRESS.....

.....

the order of loss introduced by the equaliser.)

For the present, we felt that the inductive bridge T offered some advantages, and we concentrated on developing a practical circuit around this idea. The basic circuit is shown in the accompanying diagram (Fig. 1) and some readers may recognise it as identical with the whistle filter circuit used in a number of wide range tuners.

As with the resistive network, attenuation at the selected frequency is virtually complete, but the dip is very sharp, amounting to only two or three hundred cycles at 1,000 cycles. This means that the level is back to reference long before the second harmonic is encountered.

FIXED FREQUENCIES

Unless some convenient method can be provided to vary either the inductive or capacitive components, the network responds to a fixed frequency, the variable resistor serving purely as a null adjustment. Thus it is usual to provide a number of fixed frequencies which may be selected by means of a switch.

About the simplest practical distortion meter is shown in circuit form in Fig. 2. As can be seen, it employs no valves, no power supply, and uses only a handful of components, none of which, except the meter, are particularly expensive Yet it is a perfectly practical instrument, even though, as might be imagined, its field of application is limited to those cases where a high sensitivity is not required.

Fairly obviously, it must be assumed that there is available a good quality signal generator, having a low distortion content, and being capable of being adjusted accurately to the various frequencies provided for in the distortion meter.

In a more versatile instrument adequate sensitivity is a major requirement, and much of our work in developing the current instrument was devoted to deciding what was needed in this regard, and how best to provide it. A few typical figures may help to make this point clear.

TYPICAL VOLTAGES

In the simple circuit suggested in Fig. 2 the meter has two ranges; 100 per cent and 10 per cent. The exact voltages represented by these figures are not important, provided they are accurately related in the ratio of 10 to one, but they happen to be approximately 10 volts and one volt respectively. The latter figure is about the limit of sensitivity with such a simple circuit.

This means that, if we take 10 volts as representing 100 per cent output from the amplifier, 1 per cent distortion would be represented by .1 volt on the meter. Allowing for non-linearity introduced by the rectifier—which is usually fairly severe—.1 volt will be represented by the first two or three minor divisions only on a typical meter scale. In other words, 1 per cent is close to the lower limit of the instrument.

Further, in order to achieve this, we must assume 10 volts available from the secondary of the output transformer. For a 15 ohm winding, this requires nearly 7 watts, meaning that we normally will be restricted to the push pull style of amplifier, and only where we have a suitable output impedance.

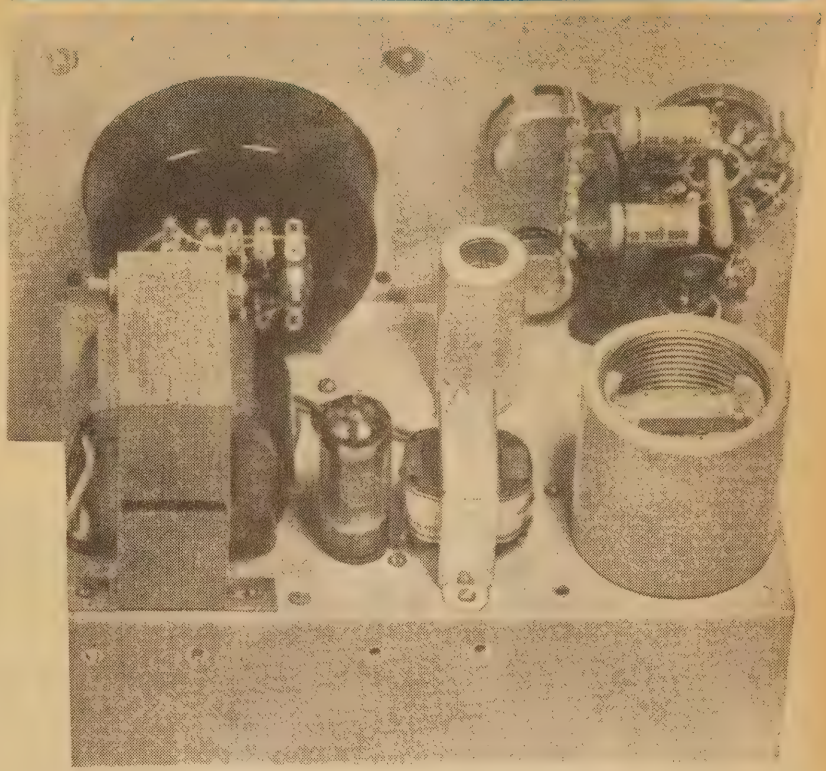
Single-ended amplifiers, having a limit of three or four watts, or transistor amplifiers from this level down, would not be capable of being checked Similarly, very few amplifiers having only two or three ohm output impedances would have enough power to develop the required voltage.

Nevertheless, provided these limitations are fully appreciated, the circuit is quite a useful one, and many readers may require nothing more for a particular application. Not the least of its advantages is that it can be mocked up into a perfectly workable form in a matter of minutes, and will give the builder his first taste of distortion measurement facilities.

To provide a more versatile instrument, we have to consider the use of amplifiers, both to increase the range of application, and to extend the level of readable distortion downwards below one per cent.

In particular, it seems logical to suggest that we should be able to check distortion in any part of the amplifier, not merely at the voice coil terminals.

A REAR VIEW OF THE METER



A rear view of the finished chassis. Right foreground is the bridge inductance in its magnetic shield, and behind it the frequency range selector switch. Only one range was wired when this picture was taken. Just visible behind the shield is the 12AU7, with the 6U8 to the left.

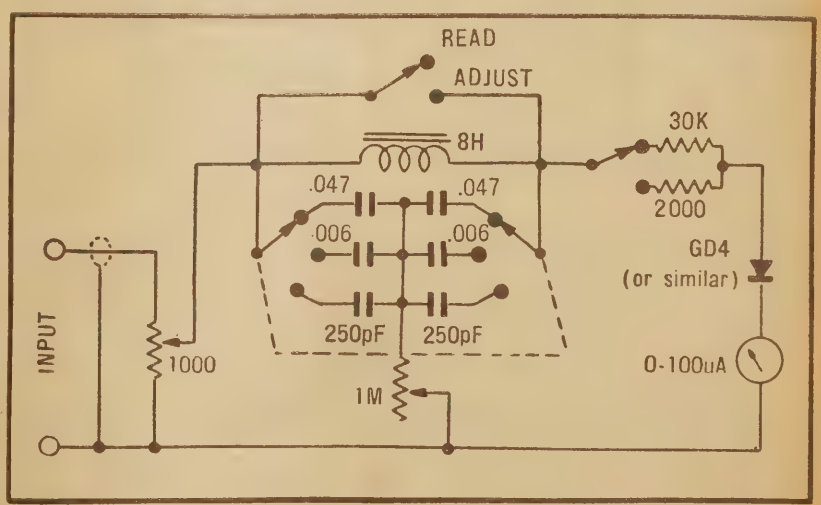


Fig. 2—A simple distortion meter circuit suitable for experiment. Although limited in its application, it is perfectly practical where the available signal level is adequate.

BE SURE AND VISIT THE...

FREE HI-FIDELITY TRADE EXHIBITITON

AT THE

MELB. TOWN HALL

FRIDAY, JUNE 12

OPEN TO THE PUBLIC FROM 10 A.M. TO 6 P.M.

See the many Trade displays
and the continuous Audio demonstrations by . . .

- A & R ELECTRONIC EQUIPMENT Pty. Ltd.
- AEGIS MFG. CO. Pty. Ltd.
- A. G. BRIDGES Pty. Ltd.
- ALEX TAYLOR & Associates Pty. Ltd.
- CYRIL STEVENS STUDIOS Pty. Ltd.
- R. H. CUNNINGHAM PTY. LTD.
- MELBOURNE TECHNICAL COLLEGE
- MANUFACTURERS SPECIAL PRODUCTS Pty. Ltd
- MULLARD-AUSTRALIA Pty. Ltd.
- PHILIPS ELECTRICAL INDUSTRIES Pty. Ltd.
- ROLA CO. (AUST.) Pty. Ltd.
- SIMON GRAY Pty. Ltd.
- ZEPHYR PRDUCTS Pty. Ltd., etc.

And in the evening don't miss the . . .

HI-FI FESTIVAL CONCERT

AT 8 p.m., ALSO IN THE MAIN MELBOURNE TOWN HALL

Compered by Geoff McComas

FEATURING GUEST PIANIST, AUSTRALIA'S OWN NANCY WEIR (a "Spotlight" artist)
SOUND DEMONSTRATIONS INCLUDING STEREOPHONIC RECORDINGS

RESERVED SEATS FOR CONCERT: 10/- & 7/6

LIMITED NUMBER UNRESERVED SEATS ON SALE AT DOOR

BOOKINGS ONLY AT MYERS—BOURKE ST.

Under the direction of James H. Magrath

PROCEEDS TO ALFRED HOSPITAL APPEAL

After all, it is not sufficient simply to know that the amplifier has a certain distortion content. If we are to locate the cause and correct it we will need to check it stage by stage or section by section.

Having decided this we felt that an overall sensitivity of around 250 millivolts would be a useful figure at which to aim, since such a sensitivity would allow checking of most control units at the output terminal, as well as main amplifiers right through to the output stage.

(By 250 millivolts sensitivity is meant a sensitivity such that this level will produce a "100 per cent" reading on whatever metering system is employed. The distortion content is likely to be only a fractional percentage of this figure.)

ONE PER CENT RANGE

In regard to the metering circuit, we felt that this should be capable of providing a "one per cent" full scale reading so that, even assuming a non-linear scale, it would be possible to read fractional percentages with reasonable accuracy. In between the "one per cent" and "100 per cent" ranges there would have to be at least one and possibly two additional ranges. We have tentatively suggested "five per cent" and "25 per cent" ranges as likely to provide adequate overlap.

Having thus listed our general requirements, we considered the various approaches we might adopt to provide them. In doing this we had to consider two important characteristics concerning the bridge-T network; (1) it requires a low impedance signal source for satisfactory operation and, (2) since it uses an inductive component it is prone to hum pickup from any adjacent power transformer.

We decided that, regardless of what other measures we could take against hum, the problem would be greatly simplified if we provided a moderate order of amplification ahead of the bridge, so that the signal would be at a reasonable level.

CATHODE FOLLOWER

To provide the low impedance source, this would have to be followed by a cathode follower stage, and a twin triode to perform both operations seemed a natural choice. The 12AU7 has a suitable order of gain and sufficiently low values of grid/plate capacitance to avoid serious Miller effect problems.

A natural query arising out of the suggestion to put a stage of amplification in this position is whether such an amplifier might not in itself introduce enough distortion to mask the true reading of the unit under test.

However, it must be appreciated that this stage will never be called upon to handle an input voltage much above 250 millivolts, or an output in excess of two or three volts. Under these conditions (remembering that a typical stage is designed to deliver between 50 and 60 volts) it is not difficult to make it virtually distortionless.

Something we did have to watch was the frequency response of this stage. Any attenuation at higher frequencies will mean attenuation of harmonics, resulting in a false distortion measurement. By selecting a suitable valve type with low internal capacitances, leaving the cathode bias resistor unbypassed, and selecting suitable circuit constants, we were able to avoid the problems which usually are associated with triode amplifiers.

The unbypassed cathode also assists in keeping the distortion at its virtual zero level.

We were able to verify this quite simply by feeding signals to the complete instrument both via the stage concerned, and direct to the cathode follower, checking the distortion content in each case. As we expected, it was impossible to detect the distortion introduced by this stage.

Further to the matter of frequency response, it may well be that a cathode follower probe may be necessary where it is necessary to measure signals across a high impedance source, assuming that the losses in the best shielded cable cannot be tolerated. We have planned the layout with this thought in mind, but more work will be necessary to establish whether this, in fact, is necessary.

BRIDGE INDUCTANCE

Coming to the bridge circuit we had to decide what form the all important inductance should take, what hum precautions to take, the frequencies to be provided and what form the null controls should take.

A commercial choke which looked very attractive was the original Geiger counter choke, type CF243. This had the right order of inductance, a good "Q," and was small physically. The latter point is a help in minimising hum pickup.

Unfortunately, this choke is no longer in production, though we believe there may be a few units still available on dealers' shelves. If you can obtain one of these it should be perfectly satisfactory.

In the meantime the makers are developing another version of the unit for use with this circuit. It should be similar electrically and, although a little larger physically, still capable of fitting in the same magnetic shield. At the time of writing we have not had a chance to test one of these, but we will have more to say about it next month.

In the matter of hum, we found it possible to orientate the choke with respect to the transformer so that pickup was virtually nil. Unfortunately, the positioning is extremely critical, as well as being upset by the proximity of other metal objects such as the case in which the unit is mounted.

Mounting the choke inside a short length of heavy water pipe removes most of these troubles, although correct orientation still is necessary. However, it is far less critical and we can truthfully say that it is not a problem, being below the valve noise level, which currently appears to be the limiting factor.

The frequencies we selected are nominally 60, 150, 1,000 and 5,000 cps. These represent about the practical limit of the range possible with a single inductance, but should be adequate for almost all likely amplifier tests. Fairly obviously other frequencies could be provided by means of alternative capacitance and/or inductance values, should they be indicated for a special case.

As can be seen from the circuit, two null adjusting potentiometers are provided, one smaller than the other. We did this because of the difficulty of providing a single value pot. which would give a smooth null on all ranges. The low frequency ranges in particular tend to be critical in adjustment and the smaller pot. provides a useful vernier.

Following the bridge is a 6U8 triode pentode, the pentode serving as a straightout amplifier and the triode as a cathode follower to feed the meter. Distortion in this section is not as important as in that preceding the bridge, since the harmonic content has now been selected. However, gross distortion, as in the case of overload, or frequency discrimination, must still be avoided.

The most important point about this stage is to ensure that it is capable of delivering enough voltage to drive the meter on the "100 per cent" scale, assuming that the "1 per cent" scale must be kept as high as possible in the interests of linearity.

If, for example, we elect to make the "1 per cent" scale a 1 volt range, then the "100 per cent" will have to be a 100 volt range and the valve will have to be capable of delivering this level without risk of clipping. Voltages approaching these are encountered in practice.

Since the resistance presented by a 1 volt AC meter, even when based on a 100 micro-amp movement, is quite low, we cannot couple it directly to the pentode circuit and still retain the requisite gain. Instead, we interpose the triode portion as a cathode follower to provide a low impedance source for the meter.

TRANSFORMER

The transformer provides a convenient way of eliminating the DC, which otherwise is rather awkward at the impedances concerned. In addition, we may score a small amount of voltage step-up from it.

The transformer we used was a small transistor "class B" driver transformer, which we happened to have on hand. However there is no guarantee that this is the ideal type and we would like the opportunity to try other types, with other ratios, before making a final decision.

In fact, we are not even convinced that this is the only possible circuit arrangement. The alternative one shown in the circuit is one we have only had time to try "in the rough", but it has a number of promising features, including eliminating the cost of a transformer and providing a near linear scale on all ranges.

Next month we hope to provide a full constructional article based on the circuit shown, and embodying any worthwhile modifications we are able to develop in the meantime. We also should have been able to organise the supply of any special components required, so that the reader may go right ahead with a complete kit of parts.

2 ADDITIONAL Q-PLUS FIRSTS

★ **A TRANSISTORISED 30W DC-DC CONVERTER SUITABLE FOR 12V. D.C. MOBILE EQUIPMENT OPERATION.**

ELEC. SPEC. (FULL LOAD CONDITIONS)

★ D.C. INPUT: 12V. @ 3A.
★ D.C. OUTPUT: 300V. @ 100mA.
★ RIPPLE: LESS THAN .5%.
★ EFFICIENCY: 80-85%
★ DIMENSIONS: $3\frac{5}{8}$" LONG. $3\frac{1}{8}$" WIDE. $3\frac{1}{8}$" HIGH.

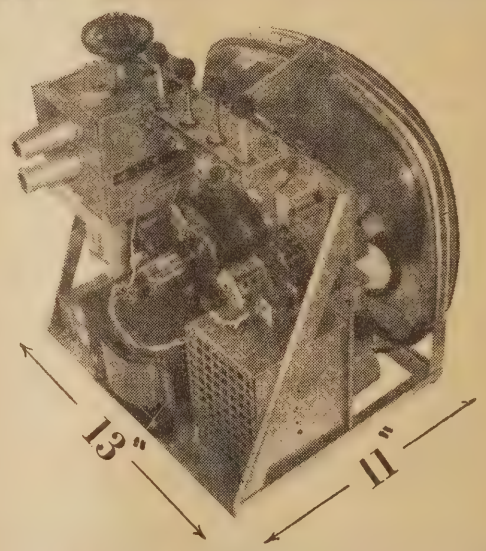
TRADE PRICE
£13/15/0
PLUS 12½% SALES TAX

★ A Q-PLUS 14" TV KIT

COMPLETE WITH ALL VALVES INCLUDING PICTURE TUBE, SPEAKER CABINET, AND EASY-TO-FOLLOW INSTRUCTION MANUAL.

NOTE THESE FEATURES:

★ FULLY RATED AND SCREENED POWER TRANSFORMER UTILISING SILICON DIODE RECTIFIERS.
★ FULL QUERY SERVICE AVAILABLE AT ALL TIMES.
★ ONLY HIGHEST QUALITY COMPONENTS USED.
★ INCORPORATING LATEST CIRCUIT DESIGNS GIVING FULL PERFORMANCE WITH 14 VALVES & 2 GERMANIUM DIODES.



BUDGET PRICED AT 99 GNS. COMPLETE

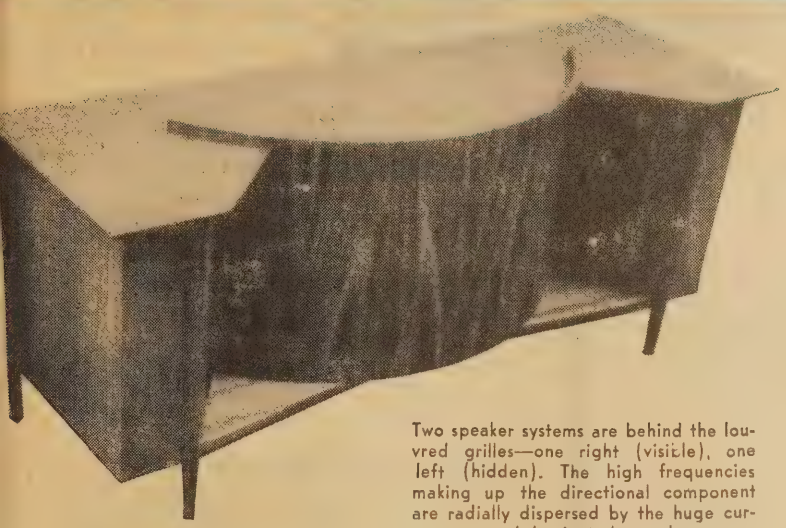
NOTE: Complete technical specifications of all Q-plus products are available from

R. W. STEANE & Co. Pty. Ltd.

HEAD OFFICE & FACTORY: MELB. 2a Montrose St., Hawthorn E3. WB3377-8-9.

BRANCH OFFICE, SYDNEY: 8 CADOW ST., PYMBLE. JX3556.

STEREO MONSTER SOUNDS SUPERB



Two speaker systems are behind the louvred grilles—one right (visible), one left (hidden). The high frequencies making up the directional component are radially dispersed by the huge curved laminated panel.

Many readers have been intrigued by the picture of the huge Lansing Paragon stereo speaker system which we published a few months ago. Here is a description and performance comment on this speaker as published in the American Hi-Fi Review.

THE James B. Lansing designers of the Paragon and Metregon have sought overcome all the difficulties usually countered in the selection and placeent of stereo speakers by creating a reo speaker system with a built-in nic environment.

By combining direct speaker radiation th a carefully calculated amount of flected sound, they have achieved a eans of producing optimum stereo und from speakers in a fixed relationp with excellent stereo spread, depth d directionality.

In the very nature of the matter, such system must be large. The Paragon easures 106 inches in length and 24½ ches in depth. Its smaller brother, e Metregon, is 30 inches tall, 22½ inches in depth and 74 inches in length.

Every square and cubic inch has its purpose.

The curved panel between the two louvred grilles acts as a sound reflector. Its purpose is to diffuse and integrate the sound waves radiated from the two speakers. Behind the curved panel is a huge padded cavity divided by a rigid separator. Each of these twin enclosures, with its ducted port, enables its own speaker system to operate at maximum efficiency.

One version of the Metregon, which can be used with several speaker combinations, has 15-inch bass drivers with exponentially loaded high frequency units. The cross-over point between the speakers is 600 cycles.

Producing and distributing stereo sound through the "sonic environment" method—partly direct and partly reflected—is exceptionally effective in preventing the "hole in the middle" that plagues many systems. The well-balanced diffusion from the two systems blends the stereo signals into a solid sound wall while the direct-reflection principle maintains direction without separating the points of sound from the main body.

This provides the kind of listening you would expect to find in a concert hall where primary directionality is from the stage, with the sound enveloping the listener rather than engaging him in a species of musical ping-pong.

As a Monophonic system, the Metregon is sensational. The sound seems to take on much of the spaciousness of stereo, often to a degree where it is hardly distinguishable.

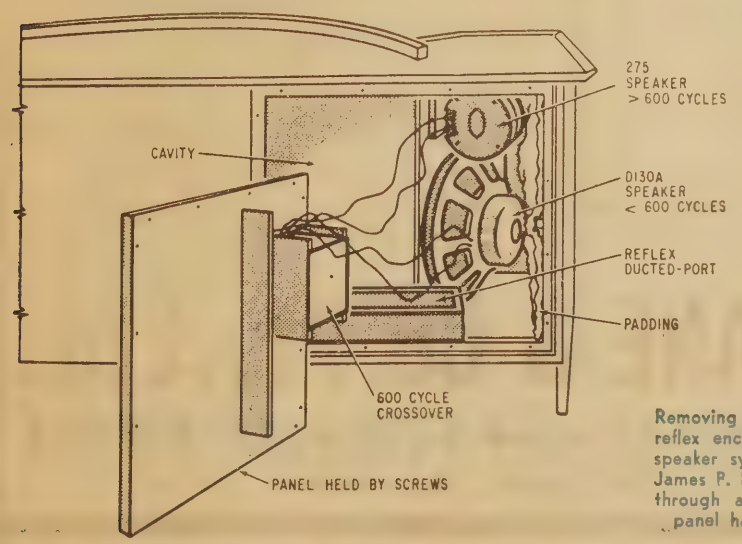
It is also very efficient. Only a small fraction of the rated output of the average amplifier is normally used, so that results are almost identical regardless of whether the driver is a 15 or 50 watt amplifier.

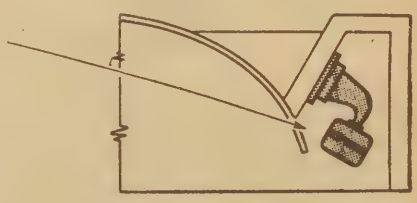
The sound is bright, crisp and clear, with an absence of cavern effect noted with some bass reflex and exponential horn systems.

Transient response is very good and the over-all bass reproduction is firm, with no sign of mushiness. Instruments are sharply delineated and speech is natural and free from sibilance.

In their pursuit of the ideal in an integrated stereo speaker system, the designers had the option of striving for the maximum sound separation possible with a given physical distance between speakers. However, their decision was rather in favour of a maximum sound spread coupled with centre fill growing out of the original speakers in a natural fusion, an acoustic principle the company terms "radial refraction."

There is an integrity in this concept that is refreshing to the serious audiophile who looks for quality before all else. Here, quality has been maintained as well as conditions met. The Metregon is an easy stereo speaker system to live with and enjoy. And, given adequate wall space, its handsome, beautifully crafted cabinetry is indeed a decorator's delight.





TOP VIEW SHOWING HORN MOUNTING

Removing back panel reveals one of the ducted-port bass reflex enclosures in the Metregon. A similar cavity and speaker system comprise the other half. New model 275 James P. Lansing driver feeds everything above 600 cycles through a right-angle horn. Crossover network on back panel has switch to attenuate level of the 275 driver.

U. R. D. FOR

Build up to the thrill of stereophonic, High Fidelity reproduction. If you already have High Fidelity, all you need is a stereo pick-up head, a second amplifier

CONNOISSEUR STEREOPHONIC PICK-UP

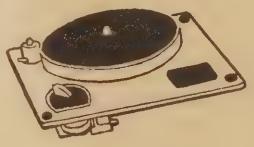
This is of the ceramic type, developing approximately 20 m.V. from normal stereo discs. The driving unit is extremely small and is mounted under the normal Connoisseur head cover and standard plug fittings. This arm is also fitted with a precision lifting device.

GOLDRING G.60 TRANSCRIPTION ARM

Wired with four contacts for Stereophonic and Monaural reproduction. Features four-contact plug-in shell so that any high-quality cartridge can be inserted. Special adjustment for height, weight and balance. Precision designed for high-quality equipment and all stereo applications.

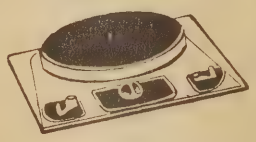
CONNOISSEUR TRANSCRIPTION MOTOR

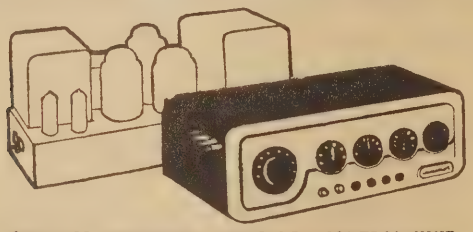
One of the finest turntables in the world. The speed change is arranged mechanically and gives a 4% variation on all three speeds. Synchronous motor, virtually vibrationless and noiseless. The main spindle, which is precision ground, runs on phosphor bronze bearings.



GARRARD 301 TRANSCRIPTION MOTOR

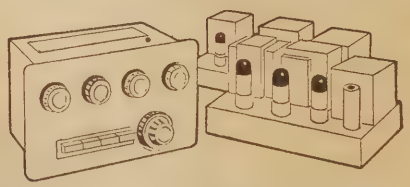
Turntable and mounting plate made in diecast aluminium. Robust induction motor floats on six tensioned springs. Turntable spindle made from high-quality steel, with bearings of cast phosphor bronze. Three speeds adjustable by plus or minus 2½%. Available from stock.





QUAD 11 AMPLIFIER AND Q.C.11 CONTROL UNIT

Without doubt the world's finest amplifier. Power output: 15 watts throughout the range 20-20,000 c/s. Input sensitivity: 1.4 V. rms for 15 watts output. Bass and treble controls designed for musical balance, independent of harmonic filtering. Push-button recording equalisation. For stereo, use two Quad Amplifiers and control units.



ROGERS R.D. JUNIOR AMPLIFIER AND STEREO-CONTROL UNIT.

This entirely new unit incorporates every essential for High-Fidelity reproduction from tape, records or radio. Can also be used for monaural recordings. The control unit may be used with two R.D. Junior amplifiers (20 watts output), or two R.D. Cadets (10 watts output), or one of each!

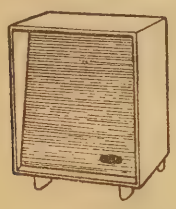
UNITED RADIO DISTRIBUTORS

STEREO IN HI-FI

with control unit, and a second speaker system.

Write, telephone or visit, at U.R.D. you'll get all the help and advice you need.

Stereo without High Fidelity is like a picture without colour.

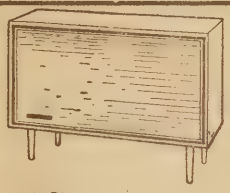


Trebax

Axiom 300

GOODMANS SHERWOOD 11

Balanced 3 — Radiator Twin-unit, Full-range, High-Fidelity Loudspeaker System. Bass and middle registers reproduced by an Axiom 300. At 5 Kc/s. signal is transferred to Trebax pressure-driven, high-frequency unit. Overall range, 30 c/s.-16,000 c/s. Capacity: 15 watts. Dimensions: 25½" x 23½" x 20½". Polished walnut or pine. Plans available.



Trebax

Trebax

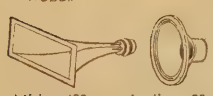
Midax 650

Audiom 60

GOODMANS AXIOM 15/4

Entirely new quadruple Radiator Full-range, High-Fidelity Loudspeaker System. Overall frequency range, 30 c/s.-16,000 c/s. Bass Unit: Audiom 60 12" single-cone unit (30-950 c/s.). Mid Range: Midax 650 pressure-driven horn unit (950 c/s.-5,000 c/s.). High Frequency: Two Trebax pressure-driven horn units (5,000 c/s.-16,000 c/s.). Capacity: 15 watts. Dimensions: 19" (plus 7" legs) x 36½" x 13¾".

Trebax



Midax 400

Audiom 80

GOODMANS 325

Complete Three-unit High-Fidelity System. Overall frequency range: 30 c/s.-16,000 c/s. Bass Unit: Audiom 80 15" single-cone unit (30 c/s.-750 c/s.). Mid Range: Midax 400 pressure-driven horn unit (750 c/s.-5,000 c/s.). High-Frequency: Trebax pressure-driven horn unit (5,000 c/s.-16,000 c/s.). Capacity: 25 watts. Dimensions: 33" x 22" x 20½".

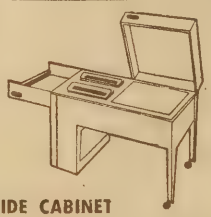
Axiette

GOODMANS AXIETTE CABINET

Single-unit High-Fidelity Loudspeaker System. Frequency Range: 40 c/s.-15,000 c/s. Axiette speaker gives excellent angular coverage at all frequencies. Power output—6 watts, yet only 8 inches in diameter. Operating at normal room volume, the most critical listener would be unable to distinguish between Axiette and more expensive systems. Dimensions: 24" x 17" x 9¾". Ideal for Stereo.

FERROGRAPH 3 S/N

The 3S series incorporates all the basic features of incomparable Ferrograph design, specially developed for Stereo reproduction from tapes. The 3S functions as a normal monaural recorder but by the attachment of the Stere-ad unit, also as a stereophonic player.
Model 3 S/N: 3¾ x 7½ i.p.s.
Model 3 S/H: 7½ x 15 i.p.s.
Stere-ad unit suitable for both models.



QUAD CHAIRSIDE CABINET

Veneered in mahogany and walnut this specially designed chairside cabinet will accommodate the Quad II control unit, FM or AM tuner, and a suitable motor and pick-up arm on the playing table. The Quad II main amplifier fits into the well-ventilated compartment below.

PTY. LTD.

175 PHILLIP STREET, SYDNEY. PHONE: BW 3718, BW 3926.

UNITED RADIO DISTRIBUTORS PTY. LTD.
175 Phillip Street, Sydney.

Please send further information about the equipment illustrated in your advertisement, particularly.....

To: Name.....

Address.....

R.H. 6/5

‹PRONTO› SOLDERING GUN

★ IS PRONTO! HOT IN 5 SECONDS.

★ YET COOL IN YOUR HAND.

★ SHOCK & KNOCK PROOF CASE.

★ PROVIDES ITS OWN LIGHT.

★ ALWAYS CLEAN AND READY TO USE.

★ ONLY WEARING PART IS THE TIP—QUICKLY REPLACED WITH 14 GAUGE COPPER WIRE.

Approved by S.E.C. app. No. V'RX'AI

Buy—PRONTO—and have no further expense.

Obtainable from all leading Electrical and Hardware Stores.

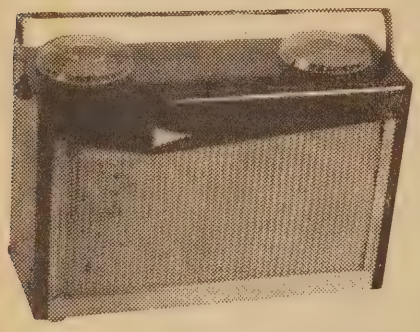
Manufactured & Distributed by

TRANSFORMERS MFG. CO. PTY. LTD.

ARGYLE ST., FITZROY, VICTORIA. TELEGRAMS: "Transformers Melbourne."

R.C.S. PRINTED CIRCUITS

TRANSISTOR — TV COILS AND KITS



NOISE SUPPRESSION

Part No.		
11	Aerial Filter Kit	93/4
20	¾ amp Line Filter	31/4
26	¾ amp Line Filter with condensers	60/-
22	5amp Line Filter with condensers	60/-
24	2amp Line Filter	37/4
27	2amp Line Filter with condensers	43/4

Above prices are trade plus 25% Sales Tax

COIL KITS

Part No.		
553	3 Channel Tuner	76/8
556	Comb. Video and Sound Strip 6AC7	110/
557	Comb. Video and Sound Strip 6BX6	115/
560	For Transporta 6 — IF's and coils and 2 Printed Circuits	76/
561	For Transporta 6 — IF's and coils	44/
563	For Transporta 7 — IF's coils, Gang and 2 Printed Circuits	105/
565	For Transporta 7 — Coils and IF's	55/4
566	For Car Radio only—IF's, coils, Gang and 2 Printed Circuits	105/

PRINTED CIRCUITS

Part No.		
558	Amplifier Audio Transporta 6 and 7	20/
559	RF Section Transporta 6	20/
562	RF Section Transporta 7	20/

DIALS AND KNOBS

Part No.		
453	Dial and Knob 300pf Gang	10/
454	Volume Knob	10/
455	Dial and Knob 415pf Gang	10/

TV I.F.'s

Part No.		
101	Tuner Coupling	14/
117	First Video 6BX6	14/
103	Second Video 6BX6	14/
104	Third Video 6BX6	14/
105	Fourth Video 6BX6	14/
106	Fifth Video 6BX6	14/
112	First Video 6AC7	14/
113	Second Video 6AC7	14/
114	Third Video 6AC7	14/
115	Four Video 6AC7	14/
110	5.5 First Centre Tap Sound	11/6
108	5.5 Second Sound Bifilar	11/6
109	5.5 Ratio Detector	18/

TRANSISTOR COILS & I.F.'s

Part No.		
248	Osc. coil	7/4
249C	Aer. Coil and Ferrite Rod	14/
251	Aer. Coil Car Radio only	14/
174	Single Tuned IF 455kc	11/4
175	Single Tuned IF 455kc	11/4
176	Dble. Tuned IF 455Kc Med Gain	11/4
177	Dble. Tuned IF 455Kc High Gain	11/4
178	Dble. Tuned IF 455kc Low Gain	11/4

ABOVE PRICES ARE TRADE PLUS 25% SALES TAX

R.C.S.

R.C.S. Radio Pty. Ltd.

651 Forest Road, Bexley, N.S.W. LW3491-5385

SOLE FACTORY REPRESENTATIVE—VICTORIA—

Distributors Corporation Pty. Ltd., 403 Bourke Street, Melbourne. MU3908.

A COURSE IN TELEVISION

PART 35—MAGNETIC DEFLECTION

Before proceeding to an examination of typical vertical and horizontal deflection output stages, it may be helpful to set forth some background information on the subject. This will include general remarks about deflection transformers and yokes, deflection voltage and current, linearity and other allied problems.

THE ability of a magnetic field to deflect the electron beam in a cathode-ray tube is a well-known phenomenon.

If a permanent magnet is brought anywhere near the C.R. tube in a test oscilloscope, the electron beam is deflected from its normal path and the spot or trace takes up a new position on the screen. At most, this is an interesting observation.

In the same class of instrument, a much more disturbing effect occurs when the stray magnetic field from the power transformer causes the beam to be deviated slightly at the mains frequency of 50cps. This may variously cause the pattern on the screen to appear defocused or to oscillate slightly at mains frequency in a particular direction.

IN TV RECEIVER

The same effects can take place in a television receiver. The beam may be deflected accidentally by a loudspeaker field magnet and it may also be deliberately re-directed, focused and centred respectively by the ion-trap, the focusing and the centring magnets.

It can be modulated accidentally by the stray magnetic field from the mains transformer, the modulation appearing to be stationary, or moving slowly upwards or downwards, depending on whether the mains happens to be synchronous or otherwise with the crystal locked vertical scanning circuit at the transmitter. The modulation may appear as an intensity variation or as a sideways undulation of the picture.

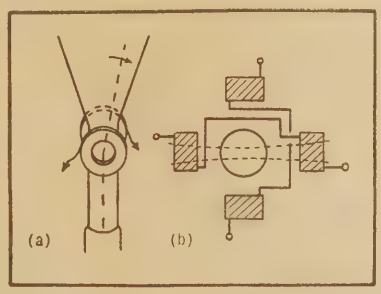


Figure 189: Two pairs of windings, placed adjacent to the neck of the picture tube and carrying deflection currents, can deflect the beam to produce the required raster pattern.

Intentional magnetic deflection of the beam, for scanning purposes, involves mounting pairs of scanning coils adjacent to the neck of the picture tube, so that they can produce a varying transverse magnetic field through the neck of the picture tube and at right angles to the direction of the electron beam.

Currents having the appropriate amplitude, waveform and frequency are then passed through the respective pairs of coils to deflect the beam simultaneously from top to bottom and from side to side, in synchronism with the original transmission.

One pair of coils must be fed with deflection current at 50cps and the other at 15,625cps. Each individual pair may be wired in parallel or in series, according to circuit convenience, but they must be connected to produce a complementary magnetic field.

They must also be so positioned on the neck of the tube and the deflection current so phased that the picture information is presented correctly to the viewer, the right way round and the right way up.

Figure 189 serves to illustrate the basic principle, being the kind of illustration which often appears in elementary textbooks on television. Deflection is possible with flat honeycomb coils of this type but they are extremely inefficient, because only a small proportion of the total field passes through the neck of the tube, where it is effective in deflecting the beam.

More usual practice, in early television receivers, was to wind the deflecting coils to an approximate rectangular shape but formed and taped so that they would fit partly around the neck of the tube. Figure 190, reproduced from our earlier course, indicates such early practice in regard to deflection and focusing.

Such coils were more efficient than the flat types, since more of the field was concentrated within the neck of the tube, while two pairs could be fitted together reasonably well in the mechanical sense.

Since then, the trend in picture tube design has been to the use of larger screens, higher operating potentials and reduced overall length. These factors have all conspired to make necessary a stronger deflecting field, which must mean, in turn, either increased magnetic efficiency or the use of larger deflection amplifier valves.

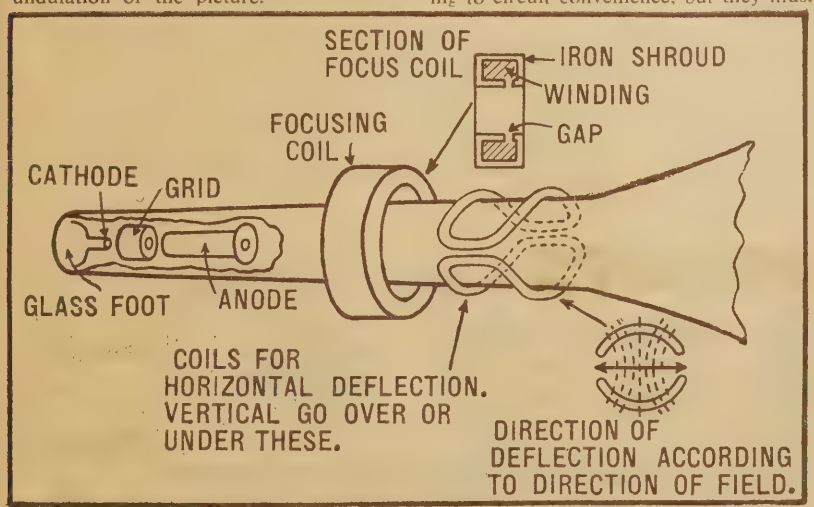


Figure 190: Reprinted from an earlier course, this diagram illustrates, amongst other things, the use of two "air-cored" deflection coils formed around the neck of an old-style picture tube. This is a far cry from modern practice.

IRON YOKE

At the present time and, in fact, for some years past, it has been regarded as impractical to develop the necessary deflecting field with "air-cored" coils, and the coils have had to be wound instead on a specially shaped iron yoke.

The effect of this latter is to concentrate the lines of magnetic force within the neck of the tube, to increase the efficiency of the magnetic circuit and therefore to relieve the demands made on the deflection amplifier valves.

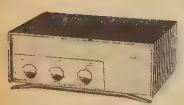
Modern deflection yokes are usually wound on a core moulded from a ferrite type of material. The core is specially shaped and the disposition of the windings carefully arranged to secure suitable deflection in both directions. It is noteworthy, also, that the latest 110-degree picure tubes have comparatively thin necks, which allows the gap in the yoke core to be made smaller and brought closer to the actual electron beam.

The design, production and testing of

P1369-59

Practically new ranch house with 200-foot, poured-concrete, spirally curled, exponential bass horn; 12-foot multicellular midrange horn (24 cells); large inventory of assorted dynamic and electrostatic tweeters; three 2,000-watt water-cooled amplifiers; infinite-attenuation electronic crossover networks; master control-mixer-preamplifier console; two 1,500-lb. belt-driven turntables suspended in mercury bath; vacuum-sealed record-positioning chamber with servo-controlled record lifters and nuclear-reactor record deionizer; foam-rubber basement for acoustical feedback isolation; also complete blueprints for construction of identical house for stereo.

A complete **PHILIPS** Sound System

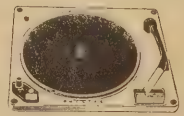

8 Watt High-Fidelity Amplifier EV4430

Bass Reflex Enclosure 1053

8" Twin Cone Speaker 9710m

12" Twin Cone Speaker 9762m

Stereo Control Unit EV4407


4 Speed Record Player AG2005Y

PHILIPS

CONTACT YOUR AUDIO DEALER OR PHILIPS ELECTRICAL INDUSTRIES PTY. LIMITED
SYDNEY BRISBANE PERTH MELBOURNE ADELAIDE HOBART

deflection yokes has become a very specialised matter and they are more a product of empirical methods and experiment than of pure calculation.

The most advanced types currently used in domestic receivers secure a total beam deflection across the diagonal dimension of a picture tube of 110 degrees and their successful development appears to have strained current techniques to the limit.

The problems of deflecting an electron beam through this very wide angle do, in fact, become very great. For example, it is essential that the beam be deflected horizontally in uniform fashion, irrespective of whether it is striking the top, the bottom or the centre of the screen area by reason of simultaneous vertical deflection.

This remark is also true in converse.

One of the designer's major tasks is therefore to control the linearity of the respective fields near the limits of beam deflection.

Failure to achieve good effective linearity shows up as a distortion of the desired rectangular raster, so that the top, bottom and sides may be bowed outwards or alternatively bowed inwards to produce what is known as the "pin-cushion" effect.

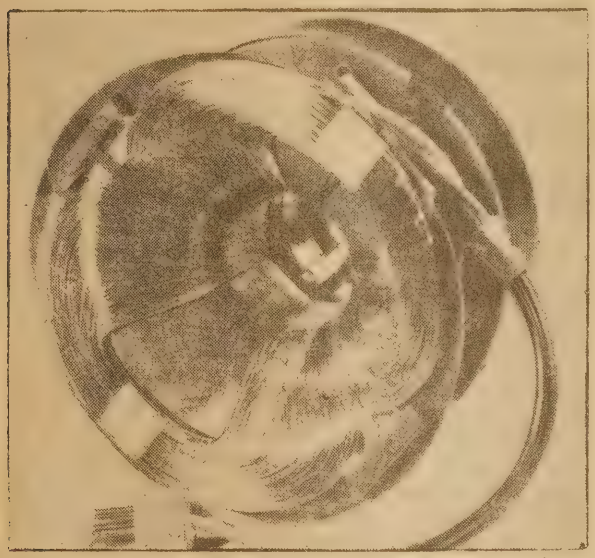


Figure 191: Rear view of a modern 110-degree deflection yoke. Note one pair of windings fanned out behind insulating cone. Clamp at back locks the yoke to the tube neck. Rings with extension levers are centring magnets.

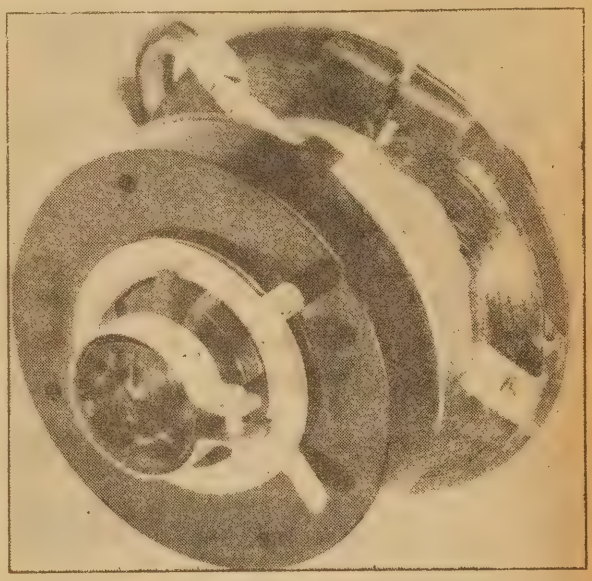


Figure 192: A front view of the same deflection yoke. Note the second pair of windings in front of the insulating cone. These rest against the tube flare. Windings are supported on moulded ferrite core.

An additional problem arises from the fact that the distance travelled by the beam to strike the centre of the screen is much less, with a modern tube, than the distance travelled when it is deflected to the outer edges. It would appear impossible in such circumstances to achieve an accurate overall focus.

The problem is attacked partly in the design of the tube but, again, the yoke can make a contribution by producing a field which has a suitable focusing action on the beam when it diverges from the axis of the tube. Unfortunately, the requirements of beam focusing are not always commensurate with those affecting the shape of the raster and some compromise has often to be made.

PRACTICAL CASES

In some cases, almost perfect linearity and focus can be achieved. It is more usual, however, to find some residual pin-cushion effect near the top of the picture and a slight amount of defocusing around the edges.

In some cases, a designer may choose to secure good overall focus as a first resort, then correct local aberrations of the raster by mounting small permanent magnets, as required, around the edge of the picture tube.

The tendency towards large, flatter-faced tubes raises another rather obvious problem in that, near the centre of the screen, the beam must illuminate a shorter line for a given deflection arc than it will near the edges and corners.

This tendency also can be corrected in part by grading the deflection field, though additional compensation is normally possible by adjusting the electrical circuits feeding energy to the coils.

Mutual coupling between the vertical and horizontal deflection coils must, at all times, be kept to a minimum both to avoid direct effects on the picture and also complications within the receiver itself.

For example, horizontal energy fed into the vertical coils and thence back into the vertical deflection amplifier can reach the vertical oscillator and influence the start of the retrace cycle.

If the effect is very serious it can cause vertical jitter while, in any case, it is likely to prejudice the accuracy of interlace.

Deflection yokes, as supplied ready for use, often include resistors and/or capacitors intended to secure complete balance and isolation between the vertical and horizontal functions. Occasionally, such balancing capacitors are made adjustable.

It is normally neither practical nor desirable to couple the actual deflecting coils directly to the anode circuits of the valves feeding them, partly by reason of the added risk of voltage and current breakdown and partly because steady and substantial DC through the windings would impose a permanent displacement on the electron beam.

Deflection windings have occasionally been shunt-fed by a choke-capacitance system, but the normal and now almost universal method is to couple them to the relevant deflection amplifier valve by a suitably designed output coupling transformer.

The plate of the output valve is thus fed through a primary winding, while energy for the yoke is derived directly across a secondary winding or via a capacitor from a tapping on the primary, in auto-transformer fashion.

A typical vertical or frame output transformer, handling deflection current at the field frequency of 50cps, is about the size of a large loudspeaker type output transformer or a small power transformer. It has a conventional laminated core and resembles the foregoing in general appearance.

A horizontal or "line" output transformer is of very different appearance. It is normally assembled on a rather large, moulded core. The primary winding, intended to operate at 15,626cps, is honeycomb-wound in the manner of an RF inductor, and tapped to provide connection points for the yoke coils and picture adjustment circuits.

For the EHT supply, as mentioned in the last instalment, an additional winding involving a very large number of turns is added, together with a one or two turn loop to supply the filament of the EHT rectifier. Operation of this component will be discussed in greater detail in a later and special article.

WINDING IMPEDANCE

The use of an output transformer to feed both sets of windings in a deflection yoke raises the obvious question as to the nominal impedance at which the deflection circuit will function.

If the yoke windings incorporate a relatively large number of turns of fine wire, they can be described as having high impedance and will need to be connected across a secondary or a tapping on the output transformer involving likewise a larger number of turns.

Conversely, it is possible to use relatively few turns of thicker wire on the

VISIT OUR NEW ENLARGED

Ground Floor

SHOWROOM

for Australia's Largest Range

of

TEST EQUIPMENT

OR PHONE OR WRITE to Harry BRAIDWOOD for full details and leaflets

PRE-STOCKTAKING OFFER OF SLIGHTLY MARKED AND DEMONSTRATION TEST INSTRUMENTS

1 only	Avo universal Avo minor	£8 + 12½%
2 "	Palec M52 multimeters	£37 + 12½%
20 "	TE 106 pencil testers (AC/DC volt 600, ohms.)	£2/17/- + 12½%
1 "	Bellinglee chan 9 only dist. amp.	£32 + 25%
1 "	Master Multirange dry battery tester	£5 no tax
1 "	H.D. Relay 50 volt coil 100 amp. contacts	£4 + 12½%
1 "	Davenset Hi dis. accumulator tester (case crack)	£3/15/- + 12½%
Large assortment of	Panel meters all types from	£1 no tax
1 only	Unimet Substandard type multimeter	£50 + 12½%
1 "	University dry battery tester	£10 + 12½%
2 "	Hansen SU2a Multimeters (soiled)	£10 + 12½%
1 "	" T.S. " (no H.V. probe)	£10 + 12½%
1 "	University TVR-EV (slightly Marked)	£45 no tax
1 "	Omega 3 Thomson Bridge (carton missing)	£30 + 12½%
1 "	" 2 imp. " (soiled)	£26 + 12½%
1 "	Univ Multirange current trans. (Ima AC meter)	£9 + 12½%
1 "	" TST2 Valve and circuit tester	£50 no tax
1 "	complete set of aerials for Klemt F/strength meter	£17/10/- + 12½%
6 "	4in sq. Oto 300 volt AC/DC Panel meters (for AC mains) perfect cond	£4/19/6 + 12½%
5 "	3in rdO to 300 " " " " " " " " " "	£4/7/6 + 12½%
1 "	Taylor 94B sweep and pattern, (slightly marked)	£150 + 12½%
1 "	" 92A " generator (soiled)	£52/10 + 12½%
1 "	Klein and Hummel pat. gen. (scratched case)	£195 + 12½%
1 "	Astor TV1 C.R.O. (marked)	£60 + 12½%
23 only	5 ma Westinghouse Bridge meter rectifiers	£1 no tax
11 "	Ima American fullwave rectifiers	10/- no tax
3 "	H.V. Probes for AVO el. test meter	£5 no tax

Also Relays, P.E. Cells, G.M. Tubes, etc. For Industrial Electronics. Free Technical Advisory Service.

Radio Parts

562 SPENCER STREET
MELBOURNE
P.O. BOX 124, NORTH MELBOURNE
PTY. LTD. PHONE FY1251

Melbourne's Wholesale House

yoke and to feed them at "low impedance" from fewer turns on the output transformer. Again, a designer may prefer to compromise for a "medium impedance" system intermediate between the foregoing limits.

Advantages are claimed for all schemes and, in practice, higher, medium, or low impedance yokes have all been used freely in this country. Individual windings are variously connected in series or in parallel, according to the ideas of the manufacturer.

In some cases, special provision is made for the user to connect windings in parallel or in series to meet individual requirements, though this cannot be done without some thought to the effect on balance and intercoupling between vertical and horizontal fields.

In typical yokes used in Australian receivers, inductance figures are quoted at 1000cps, and for the horizontal coils as 1.25mH, 6mH, 13.3mH, and 24mH resistance figures ranging from 1.4Ω ohms to 45 ohms.

Vertical deflection coils under the same conditions have inductance figures of 10.4mH, 11mH, 41mH, and 48mH, with resistance figures between 3.9 and 48.5 ohms.

DEFLECTION ANGLE

In addition to these obvious electrical differences, yokes seen in this country may have been designed for tubes having nominal deflection angles of 70, 90 or 110 degrees, and for different basic circuit configurations.

This simply means that only very rarely are deflection yokes interchangeable, any necessary replacements having to be effected with a new unit of the same make and type. The same remarks apply to vertical and horizontal output transformers and other components to do with the deflection circuitry.

Before proceeding to a specific examination of vertical and horizontal output stages, some preliminary remarks may be in place also concerning voltage and current deflection waveforms.

With a electrostatic deflection system, it is merely necessary to apply to the deflecting plates an amplified replica of the waveforms generated by the respective sawtooth oscillators. The waveforms can be inspected directly on a test oscilloscope and, by and large, deflection can be assumed to be linear if the final deflection voltage has an accurate sawtooth pattern.

With electromagnetic deflection, however, a very different set of circumstances obtains. Deflection is dependent on the instantaneous strength of a magnetic field and this is dependent, in turn, on the current through the coils. As a first approximation, therefore, it may be said that the prime requirement is sawtooth current.

VOLTAGE, CURRENT

Since the coils in the deflection yoke are inductive in character, there will inevitably be a difference in the waveform of the current through them and the voltage across them. And since the current waveform has been assumed to be of sawtooth pattern, it follows that the voltage pattern, as observed on an oscilloscope, will be something other than a sawtooth.

By the same token, the inductive qualities of a yoke will modify the plate current behaviour of the valve feeding it. Again it follows that, if the plate current pattern is to be of sawtooth shape, the optimum drive voltage applied to the valve grid will be other than a sawtooth.

In general, therefore, one can expect the voltage waveforms around an electromagnetic deflection system to be oddly shaped and not an indication of picture linearity, except in so far as they duplicate specimen waveforms set out in service date for a particular receiver.

Further amplification of these remarks must of necessity be in very general terms but may assist in a subsequent study of particular circuit arrangements.

Figure 193 is intended to illustrate the voltage and current relationships in simple resistive and inductive circuits.

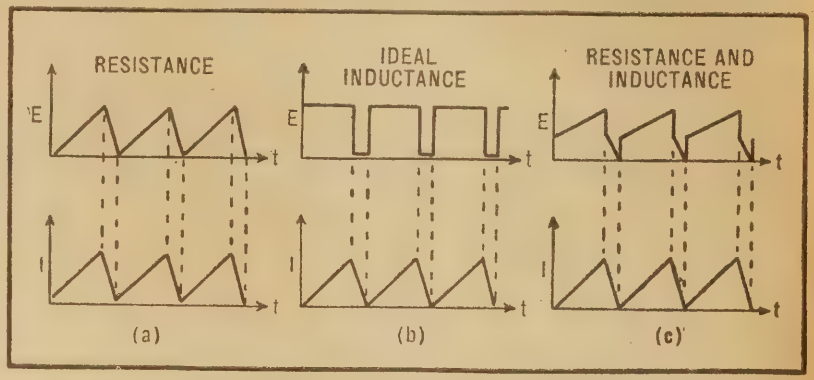


Figure 193: This diagram illustrates, in elementary fashion, the relationship between voltage and current in a resistive circuit (a), an inductive circuit (b) and a composite circuit (c).

If a circuit is purely resistive as in sketch (a) the current through it will follow exactly the voltage impressed across it.

In a purely inductive circuit, the voltage/current relationship is more like that shown in sketch (b). If a large voltage is impressed across an inductor, the current through it tends to build up gradually in a curve which resembles the charge curve of a capacitor.

The rate of current build-up and the proportion of maximum possible current achieved is a function of the inductance involved and the period during which the voltage is applied.

FIELD COLLAPSES

Upon removal of the voltage, the current will diminish and the field begin to collapse towards zero, so that an approximate triangular current law is produced by a rectangular applied voltage. However, if an asymetric or saw-tooth current waveform were required, as for television scanning, means would have to be devised for prolonging the forward trace and/or accelerating the retrace.

Practical scanning circuits are neither purely inductive nor purely resistive but contain a proportion of both. The basic voltage/current law therefore tends to a combination of (a) and (b), to produce the trapezoidal form of (c).

This general concept can be applied to the vertical output stage because it remains as a fairly straightforward link between the vertical oscillator, producing a signal voltage, and the deflection coils requiring an approximate saw-tooth current.

However, the simple concept of figure 193 is subject to many variants. For example, the proportions of L and C in the output circuit are dependent partly on the yoke and output circuit but more particularly on the output amplifier stage and its inherent plate resistance. This may vary between wide limits according to whether it is a triode or a pentode, and be further modified by the application of negative feedback, with or without frequency conscious "shaping" circuits.

Again, the scanning current law may be deliberately falsified to help correct radius error, not corrected or not properly corrected in the yoke, as mentioned earlier. In the ultimate, oscillator waveform, output stage non-linearity, yoke error and radius error may all be balanced one against the other to produce a suitably linear scanning law.

The linearity or otherwise of the retrace action is normally of no great consequence, provided it is completed within the permissible period, since the beam is normally blacked out during this period.

BARELY RECOGNISABLE

Thus, while the basic trapezoid concept can still be traced in a vertical output stage, it is likely to be modified to a degree where it is barely recognisable. In such a case, it is of far more consequence to accept the published waveforms for particular models of receiver as a basis of testing.

In the horizontal output circuitry, the concept of a valve producing a simple saw-tooth current in a yoke coil via an output transformer, has long since been abandoned. The valve can be regarded more accurately, nowadays, as an electronic switch, which initiates a rather novel cycle of magnetic events.

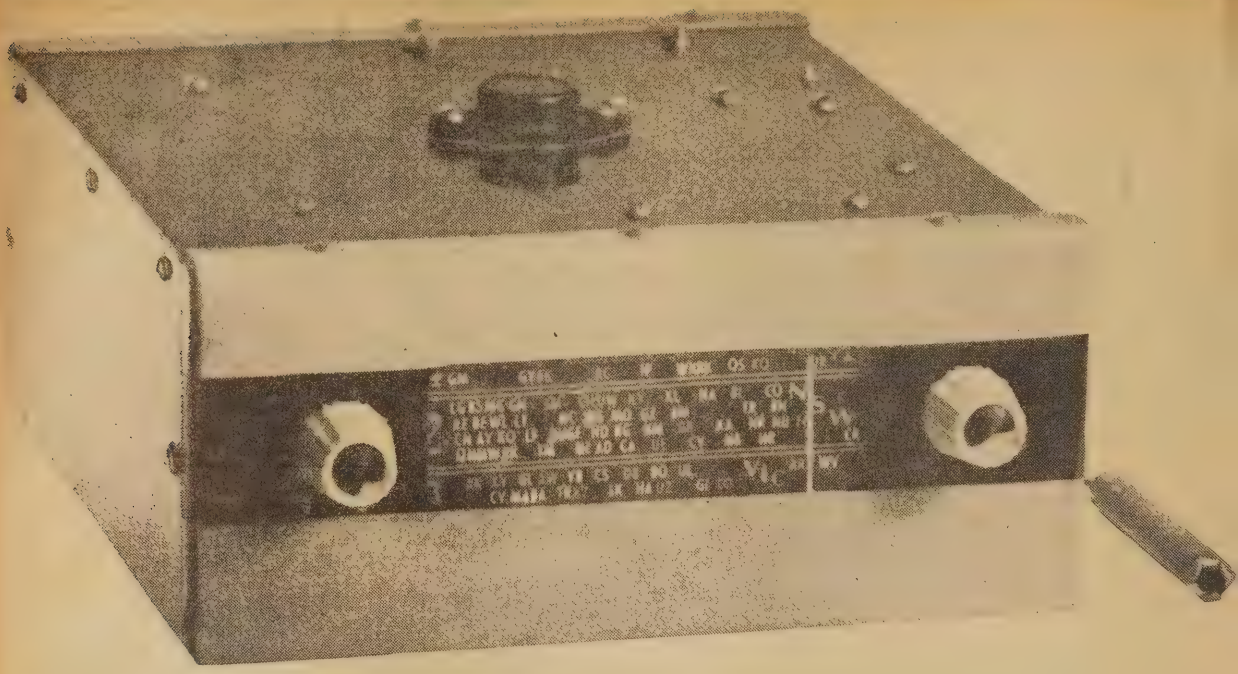
The ultimate current through the transformer and yoke is a combination of two separate components involving the line output valve and the so-called "damper diode."

(To be continued)

A NEW TELEVISION RECEIVER DESIGN

Our laboratory is currently developing a completely new television receiver for home construction. It uses the latest 110-degree deflection tubes and will fit completely within a modern slim cabinet. The emphasis is on simplicity of design, layout and construction, and it is anticipated that the total cost will be considerably lower than earlier designs. The new set will take either a 17 or a 21-inch tube, as desired.

Watch for it in a forthcoming issue!



Front view of the 1959 Karset. The power transistor appears at the top and the fuse at the right.

A Car Receiver With Hybrid Valves

Modern 12V HT valves are used in combination with a power transistor in our new car receiver which combines top performance with battery economy reliability and small physical size. The new techniques have simplified the construction and cost is appreciably less than that of previous design.

by Maurice Findlay

THE new valves are specially designed for car radio applications and operate with 12 volts applied to both heaters and plates. Since the transistors operate efficiently and are capable of delivering large amounts of power with a 12-volt supply, no vibrator is required. Thus, the least reliable component is removed, and with it any possibility of vibrator hash interference.

A detailed discussion of the subject appeared in an article headed "Designing a Modern Car Radio Receiver," which appeared in the April issue.

Briefly, the average vibrator receiver requires 6 valves in addition to the vibrator, and the current drain is of the order to 3 amps from a 12-volt supply. A receiver with the same performance could use 4 valves plus 2 transistors. The current drain would be about 1 amp. with a 12-volt supply.

It would be possible to make an all transistor receiver with a current drain of ½ amp. or less, but if sensitivity, signal-to-noise and automatic gain control action are to be comparable with the conventional receiver using valves a minimum of about 8 transistors will be required with better sets using up to 10 transistors.

Some of these transistors are worth several pounds each, and all are dearer than valves making an all-transistor car receiver a poor economic proposition. The small power requirements are attractive, but do not offset the cost, particularly when it is remembered that the generating system of a modern car is designed to take care of all sorts of accessory lights, cigarette lighters and so on.

We have carried out some experiments in our own laboratory with the object of adapting the wiring boards for the "Transporta Seven" to a car radio. However, it was found that both the sensitivity and the automatic gain control action were below the standards which could be regarded as satisfactory bearing in mind the limited pick-up of a car aerial and the low field strength spots which occur along any road, even in the city.

An RF amplifier transistor would be virtually essential plus an AGC amplifier. Aerial coil design is particularly tricky because it must be a power transfer device rather than a device to feed into a virtually infinite load. Having in mind the simple solution offered by the valve plus transistor or "hybrid" design, we decided to drop the all-transistor approach for the time being.

It is significant that the all-transistor car receivers available in America are all very expensive and use large numbers of transistors.

As far as we know there are no specialised car receivers using all transistors available in this country. However, several manufacturers are already producing hybrid receivers using 4 or 5 valves plus 1 or 2 transistors, and this is indicative of the best design trends with the present component situation.

Receivers for cars have been popular with our readers for many years. Apart from the pleasure of building the set

for themselves, there was always the thought that the design was fully understood if repairs were needed and also quite a few pounds to be saved in the overall cost. For the experienced builders a basic design was always a very useful starting point where a car receiver with special features was required.

The last of these was the "1956 Karset" and appeared in the October, 1956, issue. It is still our standard receiver for 6-volt operation.

The reason for this is that the low voltage valves do not perform particularly well with a 6-volt supply and the new design is suitable for 12 volts only. The trend in car electrical systems is definitely toward 12 volts and the great majority of new installations will be for this potential.

Although the earlier case could have been adapted fairly easily for the new electrical design, we felt that we should take advantage of the smaller size which is possible and at the same time make the receiver easier to build and service.

Overall dimensions of the new case are 7½in by 6½in by 2¾in, so that there should be plenty of room to install it in even the smallest cars. There is no power supply.

SPEAKER SIZE

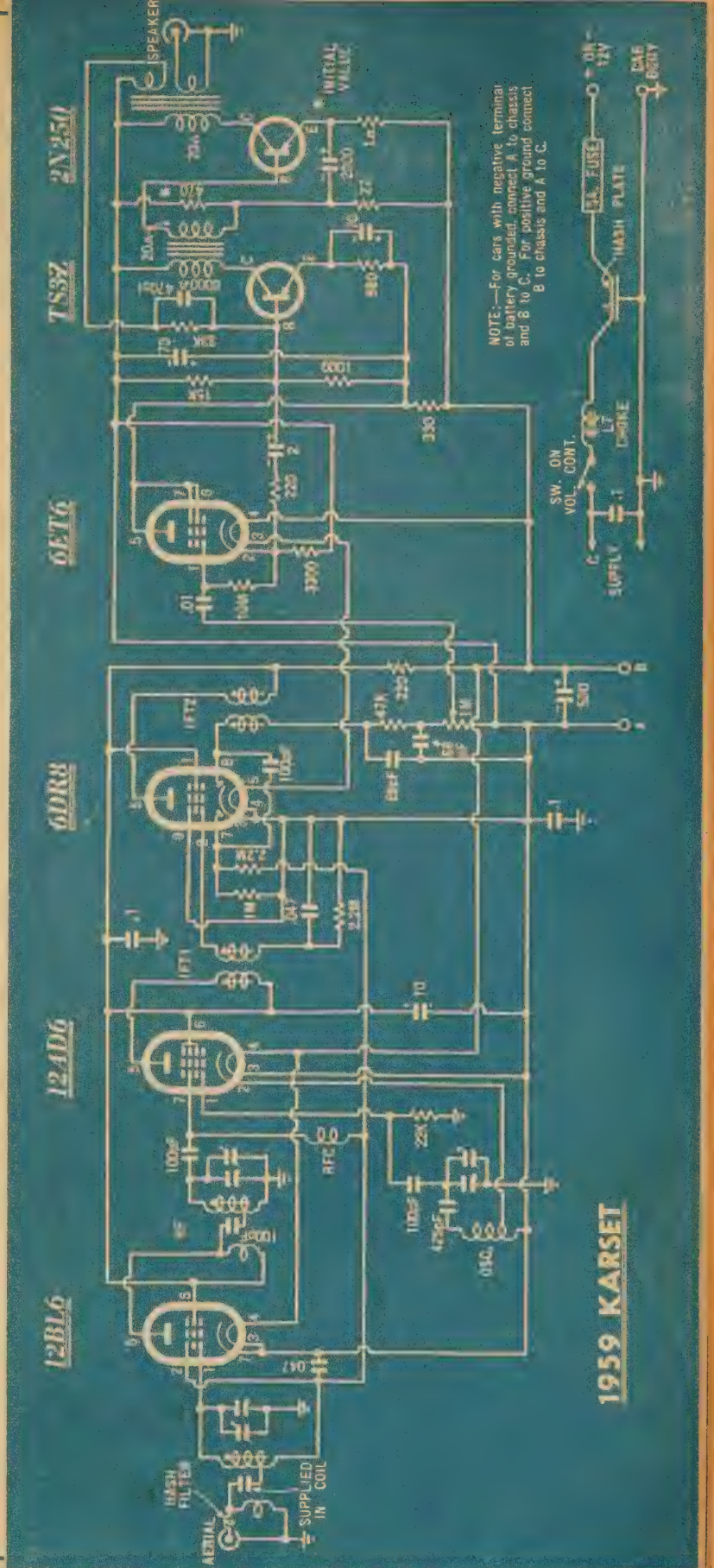
Readers who build their own receivers are usually conscious of tonal quality and, in general, would not be satisfied with the limited low frequency response which is the natural outcome of a very small speaker mounted in a compact case which also houses the receiver circuitry. If your space is very limited you can mount, say, a 5in speaker in a kick-proof metal box below the instrument panel or glove box. Alternatively, some cars have provision for mounting the speaker behind the dash board or in the head lining. The Holden car has a case section in the centre of the dashboard intended to take a 7in by 9in oval speaker. We have seen European cars with provision for speaker mounting in the front-door panels.

Because cars vary so much, the final speaker mounting position will be very much a decision for the individual owner but we strongly recommend that you use at least a 7in by 9in oval or an 8in round speaker.

In the development of this new "Radio, Television and Hobbies" car receiver, a great deal of thought was given to the mechanical design and a number of experimental models were constructed in the laboratory.

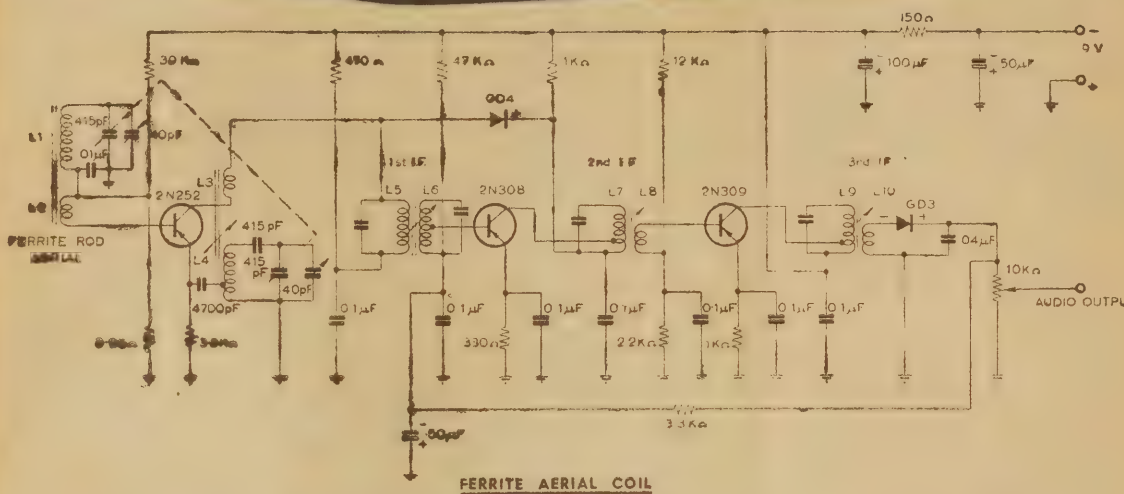
Vital to the audio output of the receiver is the need for the output transistor to dissipate power without exceeding the maximum rated temperature of the collector. A large area of metal with low thermal resistance is required and the output transistor must be mounted so that it is in intimate thermal contact with the "heat sink."

Although it is desirable to have the exterior of the case free of any pro-

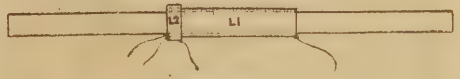


Circuit omits many of the screen and cathode resistors found in conventional receivers but includes special precautions with regard to decoupling and bypassing. It is not suitable for 6 volt cars.

STC SETS THE STANDARD FOR TRANSISTORS

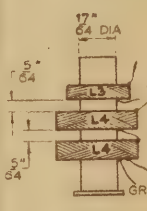


FERRITE AERIAL COIL



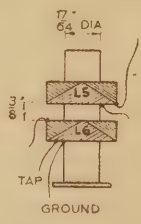
ROD: Standard Ferrite ⅜" dia., 8" long.
PRIMARY: L1 45 turns 7/41 B. & S. Litz wire.
SECONDARY: L2 5 turns 33 B. & S. double nylon-covered wire, wound over grounded end of primary.
TUNING CAPACITANCE: 40-450 pF.

OSCILLATOR COIL



TUNING SLUG: 6 mm. dia. x ½" long.
CAN ASSY.: 1⅛" x ⅜" x ⅜". 9/16" i.d. x ⅜" o.d. ring.
PRIMARY L3: 28 turns 33 B. & S. double nylon-covered wire.
SECONDARY: L4: 2 pies in series each 57 turns 8/41 B. & S. Litz wire tapped at 5 turns from grounded end.
UNLOADED Q: 85 at 975 kC/s.
INDUCTANCE: 120 µH.
TUNING CAPACITANCE: 40-450 pF.

1st I.F. TRANSFORMER

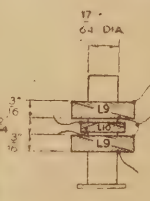


TUNING SLUG: 6 mm. dia. x ½" long.
CAN ASSY.: 1⅛" x ⅜" x ⅜". 9/16" i.d. x ⅜" o.d. ring.
PRIMARY L5 } Each 180 turns 3/41 B. & S. Litz
SECONDARY L6 } Each 180 turns 3/41 B. & S. Litz
Unloaded Q: 90
L = 340 µH.
SECONDARY L6: Tapped at 35 turns from grounded end.
TUNING CAPACITANCE: 330 pF.

2nd I.F. TRANSFORMER

TUNING SLUG: 6 mm. dia. x ½" long.
CAN ASSY.: 1⅛" x ⅜" x ⅜". 9/16" i.d. x ⅜" o.d. ring.
PRIMARY L7: 2 pies in series 8/41 B. & S. Litz wire, each 96 turns, tapped at junction.
UNLOADED Q: 90 L = 340 µH.
SECONDARY L8: 35 turns 33 B. & S. double nylon-covered wire.
TUNING CAPACITANCE: 330 pF.

3rd I.F. TRANSFORMER



TUNING SLUG: 6 mm. dia. x ½" long.
CAN ASSY.: 1⅛" x ⅜" x ⅜". 9/16" i.d. x ⅜" o.d. ring.
PRIMARY L9: 2 pies in series 8/41 B. & S. Litz wire, each 96 turns, tapped at junction.
UNLOADED Q: 90 L = 340 µH.
SECONDARY L10: 35 turns 33 B. & S. double nylon-covered wire.
TUNING CAPACITANCE: 330 pF

Australian-made S.T.C. transistors have proved their value in a vast number of applications. As the use of transistors grows, S.T.C., backed by world-wide research, is adding more new types to its already wide range. First to make transistors in Australia, S.T.C. keeps its lead in quality, reliability and performance.

RADIO TUNER UNIT Shown above is the circuit diagram of a transistorised superheterodyne radio tuner unit which has been designed to cover the broadcast band. It may be combined with various transistor audio amplifier circuits to form a complete portable radio receiver.

Although the design is simple and uses few components, it is capable of good sensitivity and selectivity. The bias for each stage is obtained in a way which gives good temperature stability, and care has been taken to ensure that the transistors are being operated correctly.

Coil design data is given below and represents a good compromise between gain and selectivity.

An auxiliary diode is incorporated to improve the A.G.C. characteristic.

PERFORMANCE

Frequency Range	530 to 1,620 kC/s.
Sensitivity	Field strength of 50 µV/m. gives 2mV. output in 1,000 ohms.
Overall Bandwidth	8 kC/s at the 3 dB. points.
Battery Drain	Approx. 3.5 milliamperes.

Full technical information and applications data are available for all transistors in the S.T.C. range—contact:

Standard Telephones and Cables Pty. Ltd.

SYDNEY • MELBOURNE • BRISBANE

DISTRIBUTORS—
S.A.: Brabeaus and Johnstone Ltd., Cornell Electronics Limited. Radio Electric Wholesalers. Adelaide: W.A.: M. J. Bateman Pty. Ltd., Perth: Tas.: W. & G. Genders Pty. Ltd.

trusions this is only possible with rather involved metal work which would increase the total cost and put the fabrication of a suitable case beyond the scope of people with ordinary metal-working facilities.

In the recommended case design the heat sink is also the baseplate of the receiver and consists of a piece of 14-gauge aluminium with two simple folds. Do not be tempted to substitute steel. This has a much higher thermal resistance and will almost certainly result in the output transistor overheating. A combination of a hot day, dark car and long operating periods may even cause complete failure of the output transistor if our recommendations are not followed closely.

CASE ASSEMBLY

A front and a back are attached directly to the heat sink and then the cover which completes the exterior case and provides complete shielding. Our drawing shows steel strips welded to the front and back of the case in such a way as to allow the cover to be fitted flush. This feature, plus welded and rounded corners, will ensure that the completed receiver will have a factory-built appearance.

Should there be any imperfections in the corners of the case you buy, it should be possible to fill them in with solder and then file smooth. The finish is important and because of the need to keep the price down, it is not always possible for the chassis makers to take a great deal of care with each individual case.

Provided it is fairly thin, motor car lacquer can be sprayed with an ordinary fly spray and on small areas be used to give a first-class finish. An etch primer will give really excellent adhesion but there are other primers which will be satisfactory and some of these can be brushed. A couple of coats with a wet abrasive paper rub down between will help to achieve a glass-like finish.

After three or four thin coats of lacquer, which can be applied within the hour, the case can be polished, first with fine cutting compound and then with one of the mild abrasive polishes.

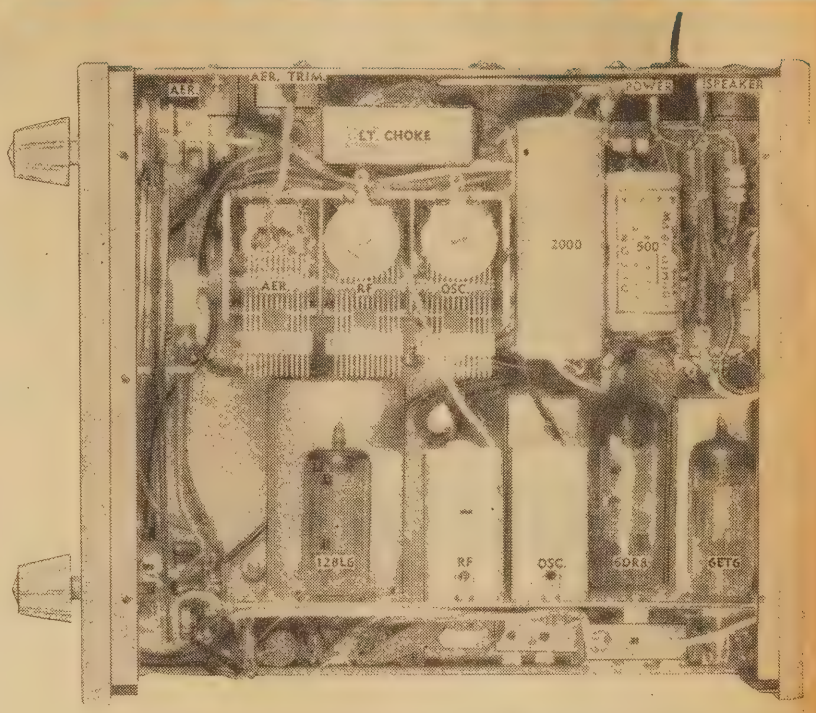
We like the effect of a plain black band containing the knobs and the dial across the front of the set. This was put on with the aid of some masking tape after the main case colour had been sprayed.

INITIAL FITTING

In initially assembling the case, a worthwhile tip is to secure the front and back to the aluminium baseplate loosely at first then fit the cover so that its edges are firmly against the ends. The front and back can then be permanently secured to baseplate and the cover removed. When the cover is later replaced it will fit correctly.

Inside the case, the tuning capacitor, driver transformer, output transformer and low tension choke are mounted directly on the 14-gauge aluminium baseplate. A subchassis mounts the four valves, aerial, RF and oscillator coils together with the first and second IF transformers. The last is on its side so that all small components are readily accessible when the main cover is removed.

THE NEW SET WITH COVER REMOVED

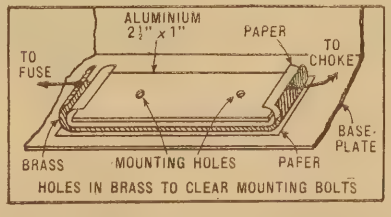


View looking down on the receiver with the cover removed. The transistor board (top right) and the tuner section (bottom) can be wired as sub-assemblies before installation

The TS3-Z is mounted on a piece of matrix board between the rear of the tuning capacitor and the back of the case (above the driver and output transformers). This board holds all wiring components associated with both transistors.

Mounting of the ouput transistor is a most important operation. It must be insulated electrically from the baseplate but at the same time the heat transfer between transistor and baseplate should be as good as possible.

There should be no lacquer on the baseplate where the transistor is to be mounted and the surface should be free from blemishes in order to ensure good thermal contact. Perhaps the safest and most practical form of insulator for the home constructor is a thin mica washer. Normally this can be obtained from the transistor suppliers, but it is quite in order to cut a washer from any piece of mica which is in good condition. The layers can be successfully split with a razor blade down to a minimum of about 0.005in.



The "hash plate" is in fact a capacitor designed to filter high frequency interference components which may otherwise enter the receiver through the power supply line. This construction ensures maximum effectiveness.

Even with the best fitting practical, there will be some air space between the transistor and the baseplate which will tend to impede the heat transfer. The position can be improved by coating both the baseplate and the transistor with silicone grease or, alternatively, ordinary motor oil of SAE 50 grade. We recommend that this be done.

Bear in mind the following facts. The temperature rise of the output transistor collector is governed by both the amount of power it is dissipating and the thermal resistance between the collector and the atmosphere. The audio power output is equal to about half the standing dissipation.

AUDIO POWER

Therefore, since maximum collector temperature is the limiting factor, the audio output of the receiver is directly dependent on the transistor mounting and heat sink.

We have allowed what we believe to be a reasonable safety margin for the conditions specified, but do not take any liberties with either the heat sink or the mounting method, otherwise there is every possibility of damaging the transistor at high temperatures.

The complete receiver may be installed with the transistor either uppermost or underneath. In some installations it may not matter but if, for example, it is to go under a parcel tray, the transistor would be best down. If it is to go on top of a parcel tray the transistor could also be down, but it would be necessary to fix a pair of spacers to either side of the baseplate in order to prevent the

JOMYSON INDUSTRIES
REGISTERED OFFICE
55 LIVERPOOL STREET,
DOVER HEIGHTS, N.S.W.
BOX 1976, G.P.O., SYDNEY

50 GNS.

COMPRISING TWO AMPLIFIERS, CONTROL UNIT AND POWER SUPPLY, ALL IN ONE

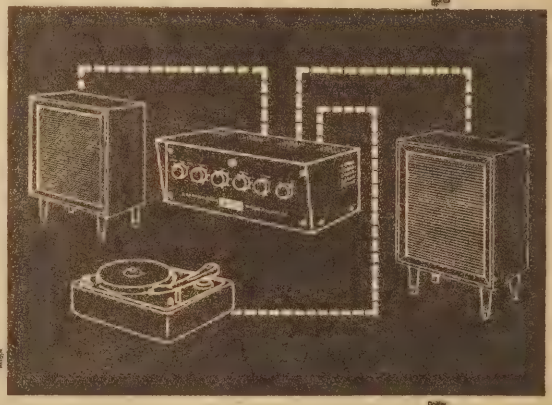
MYER 10 WATT

STEREOPHONIC HIGH FIDELITY

FREQUENCY RESPONSE - 20 c/s 40,000 c/s ± 2 db.
POWER OUTPUT . . . 5 watts each channel stereo, giving total of 10 watts overall, with negative feedback.
SIGNAL/NOISE RATIO - 60 db down with gain control at maximum.
LOAD IMPEDANCE . . . 15 ohms.
BASS CONTROL . . . . Continuously variable at 40 c/s from + 10 db to — 5 db.
TREBLE CONTROL . . . Continuously variable at 10,000 c/s from + 8 db to — 10 db.
STEREO BALANCE . . . Permits up to 14 db difference between channels.
SELECTOR SWITCH . . . Plug and socket inputs for Stereo and Monaural records, as well as radio tuner or tape.
COMPACT SIZE . . . . Measures only 4¾" high, 12¼" wide, 7½" deep. Fully enclosed design is ideal for bookshelf mounting.
FINISH . . . . . Deep anodised exterior with ultra-modern "instrument panel" black and silver colour scheme.

EACH UNIT IS RIGOROUSLY TESTED, INDIVIDUALLY NUMBERED AND FULLY GUARANTEED

A complete, integrated, 10-watt, high-fidelity stereo amplifier, ready to operate from any stereo or monaural crystal pick-up, in conjunction with any pair of 15-ohm speakers. Even speakers of different sensitivity may be used, as independent channel balance is incorporated. Styled and designed to latest U.S.A. trends, this music-lover's amplifier is now being produced in Australia at a price you can afford



WHERE TO HEAR THIS SUPERB EQUIPMENT

Before you buy a Myer Stereo Amplifier, the manufacturers want to be sure that you have a thorough personal demonstration. **If you live in Sydney, kindly ring Joseph Myer at FU 9197,** and this demonstration can be given any time on week-day, week-end, or evening, at special listening rooms in Double Bay, designed to represent average conditions just like your own home. **If you live in Melbourne, Brisbane, Adelaide, Perth, Hobart, or Canberra,** please wait for the next issue of this magazine for details of demonstrations and distributors in your district. Meanwhile, Jomyson Industries (see above) will be happy to attend mail orders and personal enquiries from anywhere in the Commonwealth.

Jomyson Industries, Box 1976, G.P.O., Sydney. Trade enquiries also welcome

transistor touching the car metalwork.

The mounting of the dial depends on the orientation of the set and the latter should be decided in advance.

Start the mechanical assembly by fitting the baseplate, front, back and cover as previously described. The dial, 2N250 transistor, hash plate, tuning capacitor LT choke, driver transformer and output transformer should follow in that order. The brackets for mounting the matrix board should be bolted in place, two on the back of the case and one on the frame of the tuning capacitor. After a preliminary fitting, the matrix board can be removed for wiring separately according to the diagram. Similarly, the metal subchassis for the tuning unit should be fitted before wiring to ensure that all is in order.

Most of the detailed wiring appears in the tuner section. Begin by mounting the sockets and coils, remembering to earth the centre spigots of all four sockets. The mounting strips and ignition suppressor choke can follow, when the detailed fitting of resistors and capacitors may be completed.

METER FOR ALIGNMENT

There is a spare lug on the mounting strip near the aerial coil. If the cathode of the 12BL6 (pin 7) is returned to the negative line through this lug it will facilitate connection of a meter for alignment purposes. An additional 0.1 uF bypassing the meter would be necessary. Cathode current of the valve without signal is about 1mA.

It is not proposed to discuss the wiring in any further detail, as most constructors capable of tackling the job with confidence will be familiar with the requirements. Provided the sockets are correctly orientated, active grid and plate leads can be extremely short. All other wires are uncritical. Positions of small components should not interfere with access to IF transformers and coils for alignment purposes.

So much for the mechanical aspects of the receiver. The electrical circuit includes a number of interesting features and warrants some discussion.

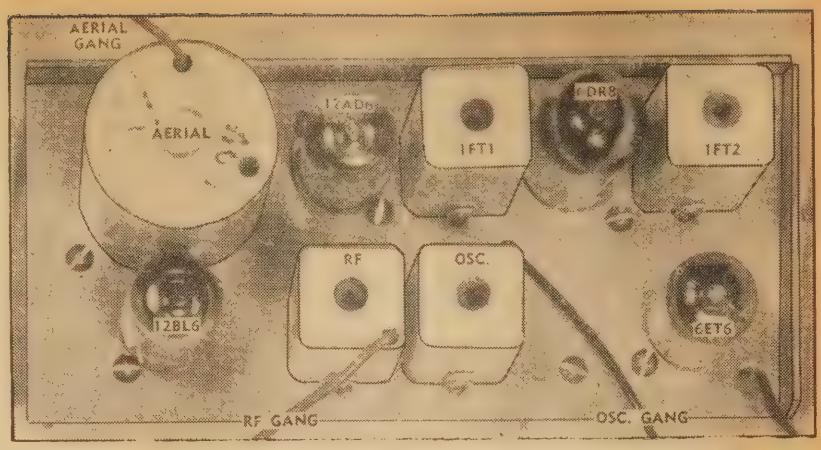
It would appear at first that no supply line filtering would be required in a receiver operating from an accumulator. However, in a car the radio must work without interference when the car generator, voltage and current regulators are working, and this makes it necessary to include an iron cored choke plus a large electrolytic capacitor.

INTERFERENCE SUPPRESSION

The hash plate is actually a capacitor designed to bypass high frequency interference components in the supply line. The arrangement shown in the diagram ensures that the capacitor has negligible series inductance.

A fuse should be included in any car radio, but in this case it is essential since an accidental reversal of the polarity would otherwise damage the output transistor. Also, if the car employs a positive ground electrical system, a short between the transistor and the car body could be disastrous without the fuse.

Design difficulties are introduced by the fact that the receiver must be capable of operating with either the positive or the negative side of the supply earthed. It would have been possible to simplify the design by making two separate receivers but the changeover from one polarity to the other would have been a major operation. This we consider to be a big disadvantage of the separate design idea.



Valves and coils mounted on the tuner sub-chassis are seen in this view.

Due to the fact that the impedance of the 12 volt supply line can never be zero, no matter how large the bypass capacitor, the varying current of the output transistor will cause small instantaneous variations in supply voltage in sympathy with the audio output.

In order to ensure complete stability it is necessary to decouple the early audio stages and the tuner stages from the output stage with resistance capacity networks.

The low voltage valves have a necessarily short grid swing on the linear part of the characteristic and under certain conditions it is possible for the audio signal superimposed on the supply line to cross modulate the incoming signal and cause feedback.

Further, to ensure complete stability, it is necessary to make all returns for both the audio and RF system to a common supply line. This may be either the positive or the negative line.

In transistor practice it is customary to make the positive line common and the reverse with transistors. Therefore a departure from normal practice must be made in one case or the other. We found it most convenient to make the negative line common and place both decoupling networks in the positive line.

A further complication arises because the receiver must operate with either the negative or the positive supply lines connected to the case to accommodate cars of either battery polarity. Since we have chosen the negative line to be common, there are no special considerations when the car battery negative terminal is grounded.

OBSCURE FEEDBACK

However, when the positive battery terminal is grounded, a feedback path between the positive supply line and the grids of the RF stage and mixer exists through the AVC bypass capacitors and coils if they are connected to baseplate as would normally be done to complete the tuned circuits in the simplest possible way.

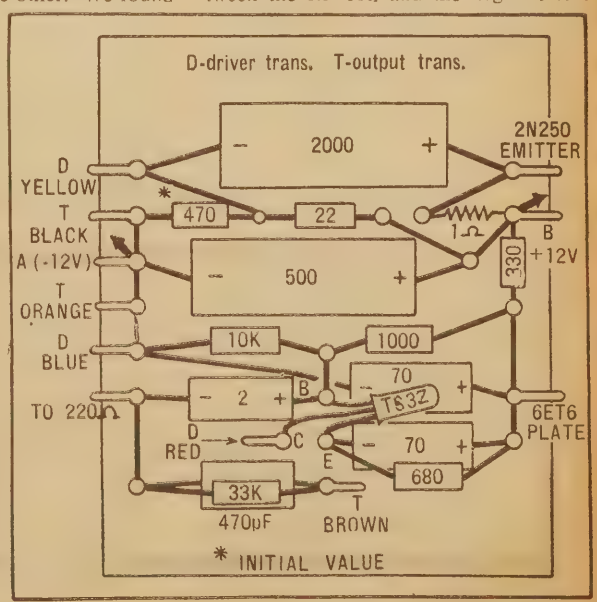
The solution is to return the AVC bypass capacitor to the negative supply line rather than to earth. This means that the input tuned circuit circulating current must flow through both the AVC and negative supply line bypass capacitors.

It is not possible to apply AVC to the mixer grid by the usual series system because an AVC bypass capacitor between the RF coil and the negative line

☆

Components mounted on top of the transistor wiring board are shown here. The 2,000 uF capacitor should not be soldered into position until the board is fixed in position since it obstructs access to the holding screws.

☆



Homecrafts PTY LTD

EVERYTHING IN RADIO AND TELEVISION

290 LONSDALE STREET, MELBOURNE — FB 3711

We have everything for the HI-FI enthusiast

Brand New—Limited Number Only
THORENS AUTOMATIC PLAYERS
in
original cartons—Model CB83N
£25
We pay freight within Victoria.

ROLA LOUDSPEAKERS

2C	1	18	6	69L	3	9	6
3C	1	12	0	8H	2	10	0
4C	1	11	6	8K	2	12	6
4F	2	1	0	8M	3	3	0
4-5C	1	17	6	8MPA	3	3	0
4-5F	2	8	0	8MX	4	10	0
5C	1	13	6	10-3G	2	15	0
5Cx	1	18	0	12K	3	6	0
5F	2	2	6	12M	4	1	0
5FX	2	5	6	12MX	6	16	6
57-H	2	8	0	12.0	6	0	0
57-L	3	3	6	12.0 De Luxe	6	10	6
6H	2	5	0				
6M	2	18	6	12-OX	11	4	0
69H	2	15	0	12-UX	28	19	6

BRAND NEW—**4 SPEED RECORD CHANGERS.** Famous make—all in original cartons. To clear at £12 Limited number only.

SCOPE SOLDERING IRON SPARES

Carbons	1/
Bits	10d
Bakelite handles	15/4
Flex heads	8/4
Centre rod assemblies	8/4
Steel barrels	8/4
Ceramic heads	4d
Retaining nuts	1/3
Switch nuts	1/8
Scope AC/DC 6V. 6 seconds soldering iron	£2/10/
Scope 230v. transformer	49/7
1/8in, 5/32in, 3/16in spin tites	11/6

YES, NOW!

We invite you to hear

THE PILOT AMPLIFIER

Demonstration in our
Hi-fi Studio
THE PILOT
made in England, is one of the finest amplifiers ever to be imported to this country.

THE PILOT
is reasonably priced at 89 gns.
When you hear
THE PILOT
You, too, will choose
THE PILOT AMPLIFIER

The Pilot can be purchased on a low deposit and very easily monthly repayments

PILOT
manufacturers of Hi-fi Ampliers
for 25 years.

Specifications: Model HFA 12 Power Amplifier.
Power Output: 12 watts.
Frequency Response: Plus or minus 1 db 15-50,000 c.p.s.
Sensitivity: 200 mV for full output.
Total Harmonic Distortion: 0.1 per cent for 8 watts at 1 Kc/s.
Hum Level: 80 db below full output
Negative Feedback: 22 db.
Speaker Output Impedances: 3, 8, and 15 ohms: simple change-over points
Damping Factor: 35.
Mains Power: 110/200-250v A.C., 40-100 cycles
Valve Line-up: EF. 86, ECC82, EL84 (2) 5Z4.
A.C. power outlet provided controled by ON/OFF Switch
Brand new Motor Scooters. To clear from £69/10/-. Easy terms.
Case: In Pale Gold finish, attractively styled All functions clearly marked.
Dimensions: 11½in wide x 6¼in high x 6.13/16in.

BRAND NEW — **Hi-fi BAKER SPEAKERS.** 12in 20-17000 c.p.s. **£14/19/6**
Limited number only—in cartons.

COLLARO

Record Player 4-Speed £12/10/0
Record Changer 4-Speed £18/17/6
Transcription Hi-fi Turn Table 4-Speed £31/2/6
The world's best COLLARO 3 Speed TAPE DECK, with 4 Hi-fi Heads £52/19/6
GENUINE OSMOR COILS to suit Collaro Tape Deck.
Set of 3 coils **£4/1/3**
plus 12½ per cent. S.T.

AVO 10,000 ohm per volt. Pocket Multimeter.
£9/12/- Plus tax
ASTOR TV-1 3in Oscilloscope. Complete with graticule, etc.
£65 plus 12½ per cent. Tax

COSSOR V.T.V.M. KIT SETS

£29/15/- plus 12½ per cent Sales Tax, Complete with instruction books, diagrams and printed circuit.

BARGAINS IN RADIO PARTS

£5,000 Surplus Radio Stocks Sacrifice.
Call and inspect our Bargain Table.

Brand New Motor Scooters

TO CLEAR
From £69/10/-
EASY TERMS

STEREO RECORD PLAYING EQUIPMENT

For the Finest Stereo and all other Record Playing Equipment.

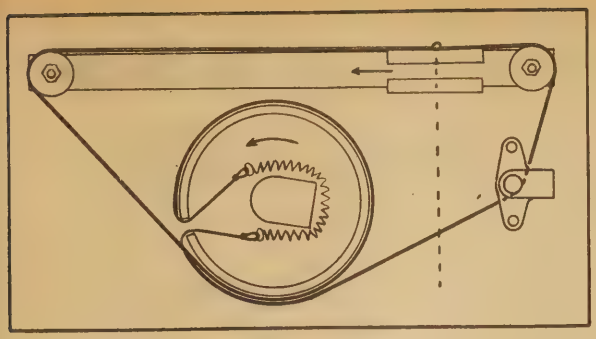
SAPPHIRE REPLACEMENT STYLI to suit Collaro. BSR Garrard, velvet action record changers and players, easy to fit yourself, 13/6 ea
DIAMOND STYLI for Collaro, BSR, Garrard players and changers £7
For Dual players and changer, std. sapphire, LP diamond, £7/11/6
B.S.R 4-speed UA8 R/Changer Stereo £22/10/
BSR. 4-speed HF8 R—Player £16/16/0

CRYSTAL CARTRIDGES:
RONETTE Turnover Cartridge (Stereo, L.P and Standard) £4/12/6
RONETTE Single Sided (Stereo and L.P. only) £4/5/6
ACOS GP71 W/Diamond Stylus (Stereo and L.P £10/17/6
(ACOS GP73 Turnover Needle Type Stereo, L.P and Standard) £5/15/0
Ditto with diamond Stereo/L.P. Stylus £11/18/6
DUAL 1004/S R/Changer, Push Button Controls. £37/9/6 (freight forward).
GOLDRING G60 Pick-up Arms specially designed for Stereo. Any Cartridge with standard, ½in mounting may be fitted £8/10/0

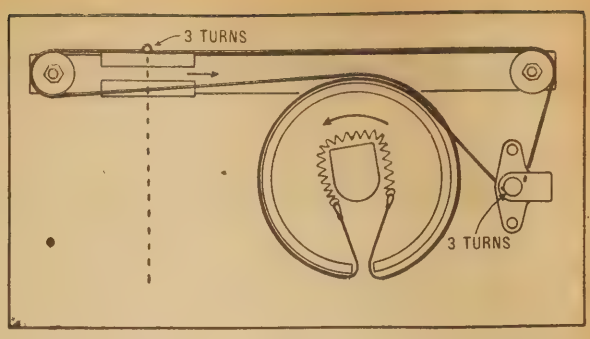
HI-FIDELITY ELECTROSTATIC TWEETERS AVAILABLE NOW
PRICE 32/6

OPEN SATURDAY MORNINGS

TRADE ALSO SUPPLIED



Dial cord layout when receiver is to be installed with transistor down. Dial glass should be carefully removed and inverted.



Dial cord layout when the receiver is to be installed with the transistor uppermost. Leave calibrated glass as originally supplied with dial.

still allows the negative line bypass capacitor to be common to both aerial and RF tuned circuit. It is not practical to keep the RF impedance between the negative supply line and baseplate low enough for the feedback to be negligible.

The difficulty can be overcome by connecting the low potential end of the RF coil direct to baseplate, including an RF coupling capacitor between the tuned circuit and the grid of the mixer, and parallel feeding the AGC supply. However, if a parallel feed resistor high enough in value to negligibly damp the RF tuned circuit is used, the audio impedance between mixer grid and baseplate is no longer high compared with the impedance from grid back to the negative supply line.

The solution is to substitute an RF choke for the parallel feed resistance. This negligibly damps the coil but at the same time permits a low impedance audio return.

To briefly discuss the remainder of the signal frequency circuits, a small inductor is included in the aerial primary. It acts in conjunction with the input capacity of the receiver to form a low pass filter and prevent cross modulation of the first stage by high frequency interference, e.g., the car's ignition system.

Capacitive in addition to inductive coupling is used with both the aerial and RF coils in order to provide even gain across the entire band.

SIMPLIFICATION

Screens of all three valves handling radio frequencies are connected directly to the decoupled positive supply line, thus eliminating dropping resistors and bypass capacitors required in normal designs.

No special oscillator coil is required with the 12AD6 mixer valve. A conventional single tapped winding designed for type 6BE6 will give the correct oscillator grid current across the band. For the purposes of check, this should be between 50 and 60 microamps.

AVC is applied to both control and suppressor grids of the 12BL6 and the signal frequency grid of the 12AD6. The object of including the 12BL6 suppressor is to obtain the best possible control characteristic to accommodate the extreme variations in signal strength encountered with the car in motion.

At the same time it is not desirable to apply AVC to the grid of the 6DR8 IF amplifier because this would impair its ability to supply undistorted high voltages to the diode detector. The valve operates at zero bias and therefore it is necessary to include a series resistor and RF bypass in the input circuit to prevent the equivalent diode formed by the grid and cathode of the 6DR8 damping the IF tuned circuit.

A special second IF transformer with a tapped primary has been recommended in order to provide optimum coupling conditions between the 6DR8 and the detector circuit. Tests made in our own laboratory indicate that the difference with a standard second IF are small. Our feeling at the moment is that a standard second IF is the most practical proposition.

With the usual simple AVC system, the control voltage is taken from the diode detector load, filtered and applied to the controlled stages. In this receiver, when the positive supply line is grounded, a feedback path from the grid of the 6ET6, through the AVC filter components and tuning capacitor to ground exists and can cause instability at the low frequency end of the band with the volume control fully advanced.

It would have been possible to ensure stability by increasing the time constant of the AVC filter network but this makes the response too slow to deal adequately with the rapid variations in signal strength which occur in a fast-moving vehicle. A solution which does not necessitate a compromise in this direction is to use the second 6DR8 diode for AVC separately when the impedance of the feedback path is high enough to be negligible.

TONE CONTROL

Some readers may desire less of the high frequency end of the audio spectrum than in the original. A "tone control" effect can conveniently be obtained by substituting a larger capacitor for the 68 pF shown from the junction of the 47K resistor and the volume control. If an extreme effect is required the value could be increased up to about .001 uF. Readers are more likely to prefer .00047 or .00022 uF. A small amount of high frequency cut is helpful where there is a great deal of electrical interference.

Transistors are fundamentally low impedance devices and an efficient coupling

PARTS LIST

- 1 special case (see drawing)
- 1 miniature dial MSL/48 or similar.
- 1 miniature 3-gang tuning capacitor, 10-415 pF
- 2 30 pF max. compression trimmers
- 1 30 pF max. screw mounting trimmer
- 1 ignition filter coil
- 1 special car radio aerial coil
- 1 miniature RF coil
- 1 miniature oscillator coil (6BE6 type)
- 1 miniature 1st IF transformer
- 1 miniature 2nd IF transformer
- 1 2.5 mH RF choke
- 1 low tension choke, max. resistance ½ ohm
- 1 driver transformer, 8,000 ohms to 20 ohms
- 1 output transformer, 20 ohms to VC with feedback winding

VALVES

12BL6, 12AD6, 6DR8 & 6ET6

TRANSISTORS

TS3-Z & 2N250 (with mica washer)

RESISTORS

- 1 10 meg, ½ watt
- 2 2.2 meg, ½ watt
- 1 1meg potentiometer, with switch
- 1 1 meg, ½ watt
- 1 47K, ½ watt
- 1 33K, ½ watt
- 1 22K, ½ watt
- 1 15K, ½ watt
- 1 3.3K, ½ watt
- 1 1,000 ohm, ½ watt
- 1 680 ohm, ½ watt
- 1 470 ohm, 1 watt
- 1 330 ohm, ½ watt
- 2 220 ohm, ½ watt
- 1 22 ohm, 1 watt
- 1 1 ohm, 1 watt wire wound

CAPACITORS

- 1 2,000 uF, 2.5 VW electro
- 1 500 uF, 16VW electro
- 1 70 uF, 15 VW electro
- 1 2 uF, 25 VW electro
- 4 0.1 uF, 100 VW disc ceramic
- 1 0.047 uF, 100 VW disc ceramic
- 1 0.01 uF, 200V plastic
- 1 470 pF, 600V plastic
- 1 425 pF 5pc silver mica
- 4 100pF 600V plastic
- 2 68 pF ceramic
- 3 7-pin miniature sockets
- 1 9-pin miniature socket
- 2 miniature bayonet sockets and plugs
- 1 bayonet fuse holder
- 1 5 amp. fuse
- 1 8-tag mounting strip
- 1 7-tag mounting strip
- 1 3-tag mounting strip
- 1 9-hole by 11-hole matrix board
- 3 brackets for above

2 knobs, 4in nuts and bolts, sheetmetal screws (No. 4 x 1/4in binding head), 7 by .010in plastic hook-up wire, scrap brass and aluminium for hash plate, etc.

STANDARD 19 inch RACKS

★ Solid construction with strong gusset welding on each of the four corners, ensuring rigidity.

★ Standard panel mounting hole spacings, drilled and tapped ¼ inch Whit., held to plus or minus 1/32 inch tolerance.

★ Cable clamps can be fitted to inside of each vertical channel.

★ Each Rack is normally drilled and tapped to accommodate cable clamps which can be supplied as an extra.

★ Mounting bases can be provided with bolts in lieu of welding if required.

★ Finish: Battleship Grey.

★ Manufactured to P.M.G., R.A.A.F., D.C.A. and other Government Department specifications.

ZEPHYR

PRICE :
Part No. 158
7-FOOT RACK
£16/16/0
incl. sales tax
Part No. 159
8ft. 6in. £19/0/0
Freight & Packing additional.

•

Racks of other heights—price on application.

•

Enquiries for Special Racks welcomed.

ZEPHYR PRODUCTS PTY. LTD. 58 HIGH STREET, GLEN IRIS, S.E.6, VIC.
PHONES: BL 1300, BL 4556

YOURS FOR 7 DAYS FREE EXAMINATION

NEWNES' GREAT NEW PRACTICAL HANDYMAN

PUT MONEY IN YOUR POCKET by DOING YOUR OWN REPAIRS, RENOVATIONS. All you need is the know-how of the experts in Newnes PRACTICAL HANDYMAN.

The most simple, comprehensive "do-it-yourself" ever published!

How your house is constructed • Wall coverings • Painting, inside and out • Hot-water systems • Door locks • Glass roof • Fences, gates • Concrete work • Laying lino. and stair carpet • Windows • Built-in furniture • Shelves • Re-upholstering • Making cabinets, toys, stools, picture frames • Electrical repairs • Dry cleaning • Motor car troubles . . . and much more besides!

IT COSTS YOU NOTHING TO EXAMINE PRACTICAL HANDYMAN. You receive for FREE examination:

2 VOLUMES strongly art vellum bound with protective dust jackets.

18 HOW-TO-DO-IT CHARTS in special case. Indoor, outdoor furniture, toys, etc.

127 main sections — house structure, decoration, repairs, handiwork.

864 pages. Easy to follow.

1,500 helpful illustrations.

To GEORGE NEWNES (AUST) PTY. LTD., PH.48
Newnes House, 20-22 Margaret Street, Sydney.
Please send me Newnes PRACTICAL HANDYMAN (two volumes and case of charts) without obligation to purchase. I will either return the work within eight days or I will send the first payment of 20/- eight days after delivery and 9/- monthly thereafter, until the sum of £9/9/- has been paid. Cash price within eight days is £9.

PLACE X WHERE IT APPLIES

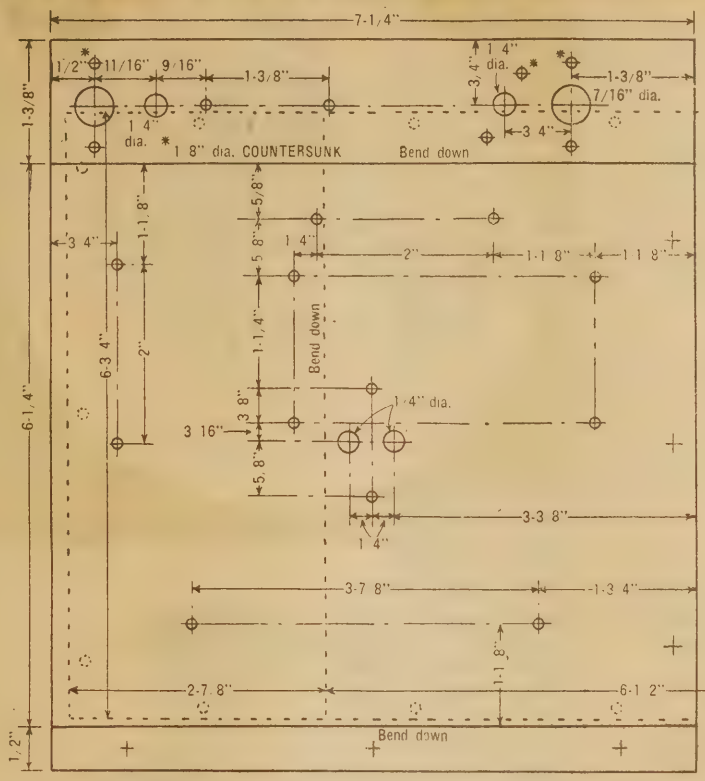
NAME .....

ADDRESS .....

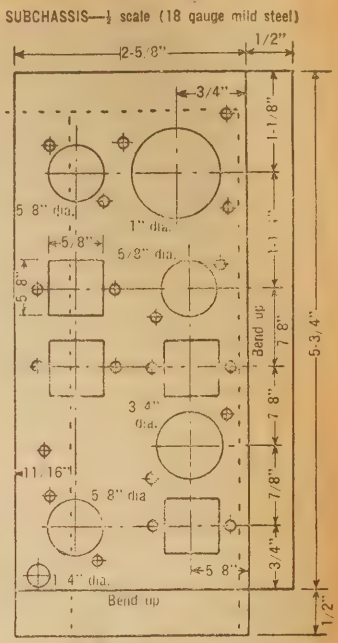
OCCUPATION .....

YOUR SIGNATURE .....
(or your parent's signature if under 21)

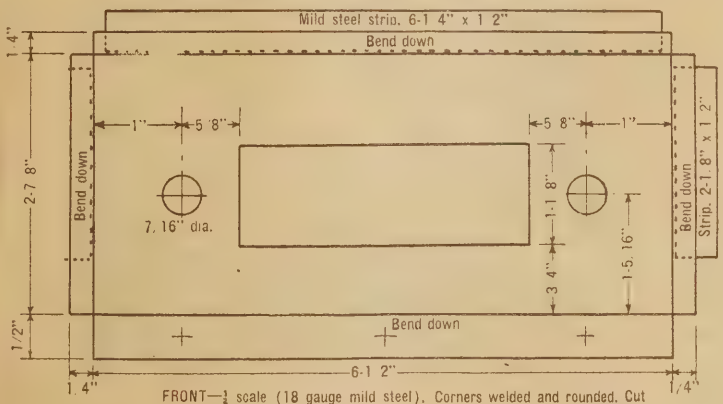
Householder	
Tenant	
Living with Parents	
Lodging Address	



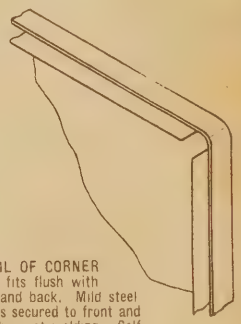
BASEPLATE—½ scale (14 gauge aluminium). The baseplate serves also as a heat sink for the power transistor. It should preferably be finished a dull black colour to assist heat dissipation. Steel is not suitable because its heat conductivity is not as good as aluminium.



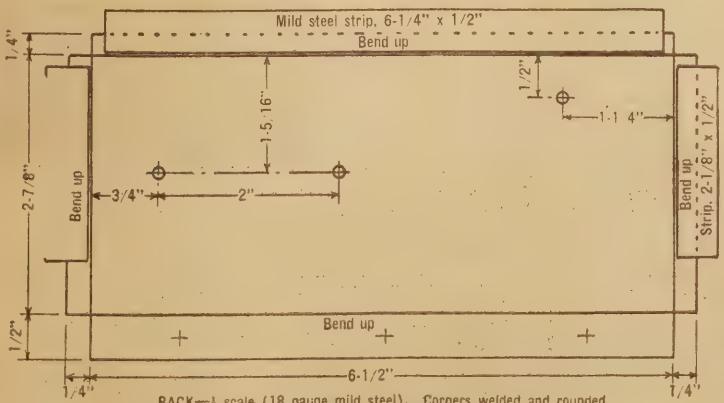
COVER—½ scale, shown in broken lines (18 gauge mild steel). Holes drilled to coincide with holes in ends and baseplate. Secured with self-tapping screws.



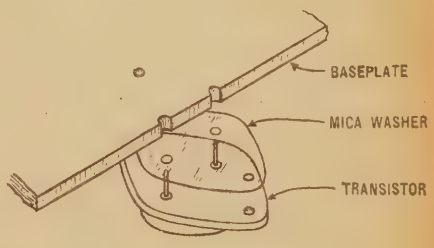
FRONT—½ scale (18 gauge mild steel). Corners welded and rounded. Cut out to suit MSL/48 dial. Mild steel strips are secured by spot welding.



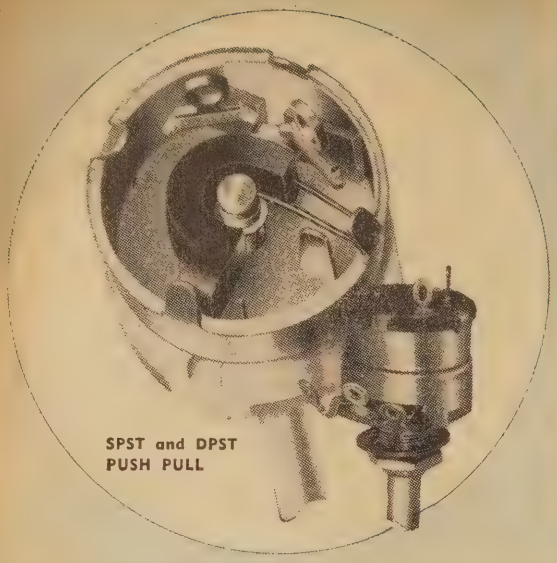
DETAIL OF CORNER
Cover fits flush with front and back. Mild steel strip is secured to front and back by spot welding. Self-tapping screws secure cover to strip. Corners are welded and filed smooth.



BACK—½ scale (18 gauge mild steel). Corners welded and rounded. Mild steel strips are secured by spot welding.



DETAIL OF TRANSISTOR MOUNTING
A mica washer is used to insulate transistor electrically from baseplate while allowing good thermal contact. Silicone grease or even motor chassis grease will assist in obtaining a good heat transfer.
There should be no lacquer at transistor site.



SPST and DPST
PUSH PULL

SPST and DPST
ROTARY

WORLD RENOWNED MALLORY
FLOATING RING ALLOY CONTACTS

AVAILABLE NOW WITH ALL DUCON POTENTIOMETERS

Ducon Potentiometers Types SPST and DPST use world famous silver plated Mallory Contact alloy in an entirely new floating ring contact principle

It's new! **It's simple!** **It's reliable!**

Positive alignment of contacts. Continually changing contact surfaces.

Ruggedly constructed.

No current carrying springs.

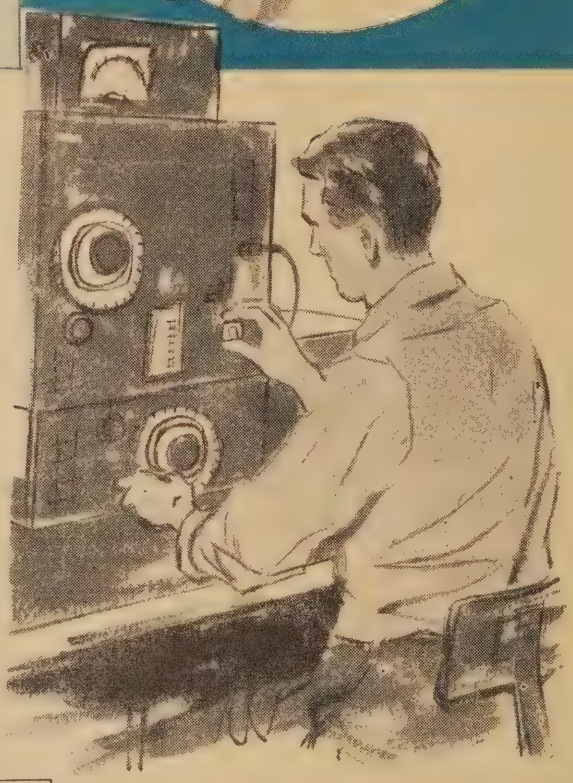
High current carrying capacity.

Low contact resistance.

Life expectancy considerably greater than 10,000 operations

Voltage tested to 1,000 volts RMS between terminals and terminals to case.

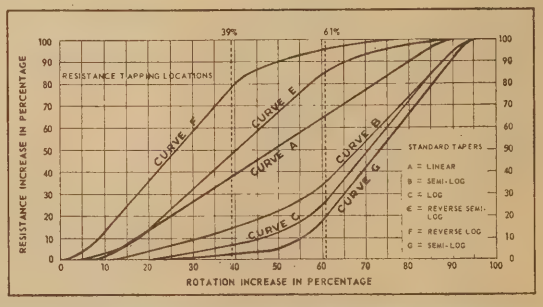
Switch cup welded to element section cup.



DUCON POTENTIOMETERS WITH PUSH-PULL LINE SWITCH		
TYPE	NOMENCLATURE	
	GENERAL	DETAILED
PSP	Single potentiometer with push-pull switch.	One resistance element section, plus one switch section.
PDP	Dual potentiometer with push-pull switch.	Two resistance element sections with concentric shafts, one shaft to each section, plus one switch section operated by inner concentric shaft.
PGP	Ganged potentiometer with push-pull switch.	Two resistance element sections on common shaft, plus one switch section.

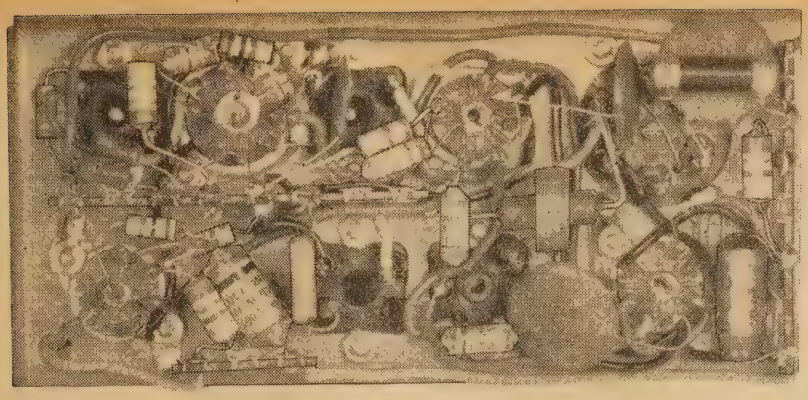
DUCON POTENTIOMETERS WITH ROTARY LINE SWITCH		
TYPE	NOMENCLATURE	
	GENERAL	DETAILED
PSS	Single potentiometer with rotary switch.	One resistance element section, plus one switch section.
PDS	Dual potentiometer with rotary switch.	Two resistance element sections with concentric shafts, one shaft to each section, plus one switch section operated by inner concentric shaft.
PGS	Ganged potentiometer with rotary switch.	Two resistance element sections on common shaft, plus one switch section.
PAO	Single, printed circuit potentiometer with rotary switch.	One resistance element section, plus one switch section.

3



Expect more . . . get more from DUCON

DUCON CONDENSER LIMITED, Leightonfield Works, Villawood, N.S.W. UB 0133



Components underneath the tuner sub-chassis. All can be reached when it is mounted in the case but the wiring job is much easier if it is carried out beforehand.

between a thermionic diode detector and a transistor audio stage is difficult. A step down second IF transformer feeding a germanium diode detector could have been used but would have introduced problems with AVC supply and would have cost more than the arrangement employed since the 6DR8 includes diodes.

Although it seems logical to completely transistorise the audio section of the receiver it proves to be a better proposition to use the 6ET6 as a cathode follower to make the changeover from high to low impedance circuitry. Although it does not provide voltage gain it does give power gain and pass on a signal that is, in effect, amplified, to the base of the TS3-Z.

The latter is a transistor similar to the TS3 except that it is rated to withstand higher collector voltages. Its operating point is stabilised for all practical operating temperatures by a conventional resistive network.

AUDIO DECOUPLING

Note that the decoupling resistor for the TS3-Z and 6ET6 circuits is in the positive line.

Coupling from the TS3-Z to the 2N250 is via a transformer designed to match 8,000 ohms to 20 ohms and the 2N250 is coupled to the speaker voice coil by an output transformer reflecting 20 ohms to the primary.

A resistive stabilising circuit protects the 2N250 against normal temperature changes but is not capable of maintaining the correct collector current for samples of the 2N250 throughout the normal beta tolerance range.

Our recommendation is that you wire the receiver initially with a 470 ohm resistor in the top of the base circuit resistive divider. This resistor is marked "initial value" in the circuit. If you have no meters, this value can be left in position until you are able to obtain further assistance. The worst that can happen is that the audio power output of the receiver will be less than normal.

If you have a meter, connect it in series with the collector of the 2N250 and note the current. If it is less than 0.45 amps, try connecting 1,000, 680 or 470 ohm resistors respectively in parallel with the original 470 ohm until the collector current comes as near to 0.45 amps as possible.

Some readers will have a voltmeter but no means of measuring 0.45 amps accurately. In this case it would be possible, but slightly less accurate, to connect the meter across the 1 ohm resistor in the emitter circuit when a reading of 0.45 volts will correspond to the required current. The supply should be 12 volts, measured at the accumulator.

A 1 ohm 1 watt resistor may not always be readily obtainable. The material used in an ordinary jug element can be soldered and will make a resistor capable of carrying the current. We found that it required nine turns of the coil plus about 1/8in each end to make up the 1 ohm resistance. We advise you to check the result with an ohmmeter.

Full shielding is necessary for the voice coil line between receiver and speaker. Speaker plugs providing for two shielded wires are expensive and bulky and we are largely forced to use a simple bayonet adaptor which requires one side of the line to be connected to baseplate.

KARSET DATA

Normal operating voltage: 12V
Current drain at 12V: 1.1A approx.
The receiver will operate satisfactorily with a supply ranging from 10.5 to 15.5 volts but for longest valve life, it should be as close to 12 volts as possible.
2N250 collector current: 0.45A
12AD6 osc. grid current: 50 uA.
Polarity: Receiver may be operated with either positive or negative supply line grounded. See circuit diagram for details.
OPERATION WITH REVERSE POLARITY WILL CAUSE SERIOUS DAMAGE.

This introduces difficulties with the audio feedback system when the polarity of the supply is reversed and makes it desirable to use a third winding for feedback. A phasing capacitor is included to obviate the possibility of oscillation with normal transformer tolerances.

Alignment of the receiver follows normal superhet practice and may be carried out either with the aid of a low impedance output meter or a milliammeter in the cathode circuit of the 12BL6 as described previously. In both cases the signal from the station or the signal generator should be as weak as possible consistent with definite indication.

Constructed with care and carefully adjusted, the 1959 Karset will compete favourably both in terms of appearance and performance with any commercial car receiver.

VHF

VIV HANSON ELECTRONICS

PTY. LTD.
280 EDWARD ST.,
BRISBANE
(next Y.M.C.A.)

HIGH FIDELITY

AND

AUDIO EQUIPMENT

WE DESIRE TO ANNOUNCE the opening of the undermentioned departments under the management and supervision of Mr. H. CUNNINGTON. He is available to advise you with all your problems of construction and installation at our EDWARD STREET AUDITORIUM.

1. RECORD PLAYING EQUIPMENT

High fidelity playing equipment manufactured by QUAD, LEAK, ROGERS, ARMSTRONG, MULLARD, PHILIPS, VERDIK, and others is always available for demonstration and sale. We can build you a high fidelity record player incorporating any of the above amplifiers with or without a radio tuner.

2. GENERAL AUDIO EQUIPMENT

Hi-Fi components; pre-amplifiers and amplifiers; turntables; pick-up arms and styluses; Goodman's, Wharfedale, etc., speaker systems and speakers; frequency dividing networks; speaker enclosures; "music-while-you-work" systems tape recorders by Ferrograph, Bayer, Philips, etc.

3. COMMUNICATIONS SYSTEMS

2-way radio systems for land, sea and air communication pick-ups.

A DEMONSTRATION PANEL incorporating several amplifiers, and turntables and a frequency modulation tuner has been set up for the purpose of demonstrating different combinations of amplifiers, pickups and speaker systems. Mr Cunnington will be pleased to demonstrate to you any combination of equipment that you may wish to hear.

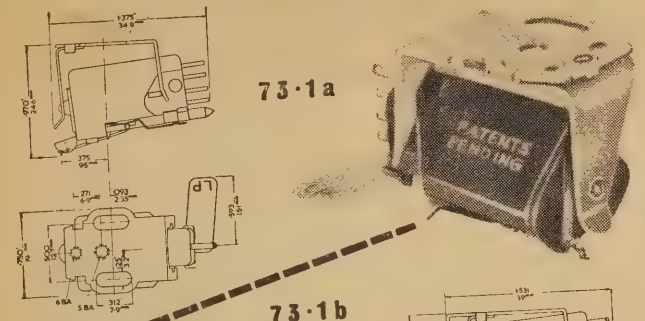
ANY EQUIPMENT MAY BE HAD FOR CASH OR UPON EASY TERMS.
Call, write or send for particulars of any equipment which interests you.

Enquiry entails no obligation to purchase and all advice and quotations are entirely free.

RECORDS: Our record department contains a large selection of classical, light classical, and popular music.
Stereo records available on application.

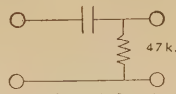
acos

Crystal stereophonic cartridge



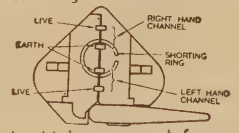
The "ACOStereo" 73-1 is a universal cartridge designed to play sterephonic and monophonic discs, including 78 r.p.m. coarse groove records. Three brackets, are available. The "a" bracket fits the majority of arms, the "b" bracket fits Garrard RC. 110 and RC. 120 changers, and the "c" bracket is intended for American arms of the VM type.

The output from the "ACOStereo" 73 is flat when fed into a 2 Megohm impedance. If record compensation is available in the amplifier, it is advised that the output is converted to constant velocity characteristics by feeding through this circuit:— 520 pF



The left-hand channel is defined as the channel reproduced by the left-hand speaker when viewed by the audience and is recorded on the left-hand groove wall when the record is viewed as:—

The "ACOStereo" cartridge connections as seen from the rear:—

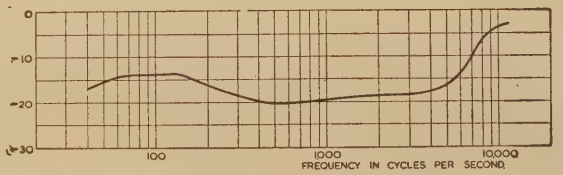


The shorting ring should be removed for use with amplifiers requiring separate leads.

PERFORMANCE OUTPUT — 160 m.v. at 1 cm/sec.
Average — 300 m.v.

FREQUENCY RESPONSE— 40—12,000 c/s.
SEPARATION between channel at 1 K/cs better than 20dB.
Radii of Stylus tips—0.0005" (13.5 microns).
0.0025" (62 microns).
Recommended load: 2 Megohm.
(Compliance equals 3.5 ucm/dyne).
(Stiffness equals 0.0286 x 10 dynes/MM).
Recommended downward pressure: 3-4 Grammes.
The Stereo recording characteristic is within ½dB of the RIAA/BS 1928/1955 characteristics, and cross talk is better than — 20db at 1 K/cs.

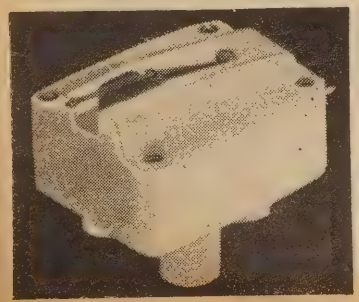
Frequency response on PS.131.



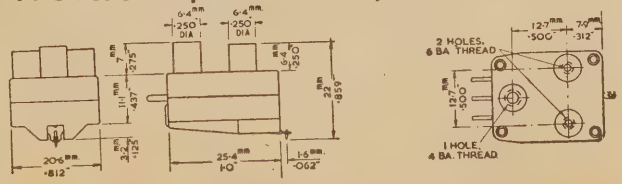
Separation between Channels on PS.131.

The response of both channels will be within 3dB.

All 73 series cartridges are available with two sapphire, sapphire and diamond, or two diamond styli.
Prices: 73 series — Cartridge incl. 2 sapphire styli, £5/15/ — with sapphire and diamond styli £11/18/6 — with 2 diamond styli £15/19/6.
Available ex stock.
"How Stereo Works" gladly posted on request.



71-3 For stereophonic discs only (non turnover type)

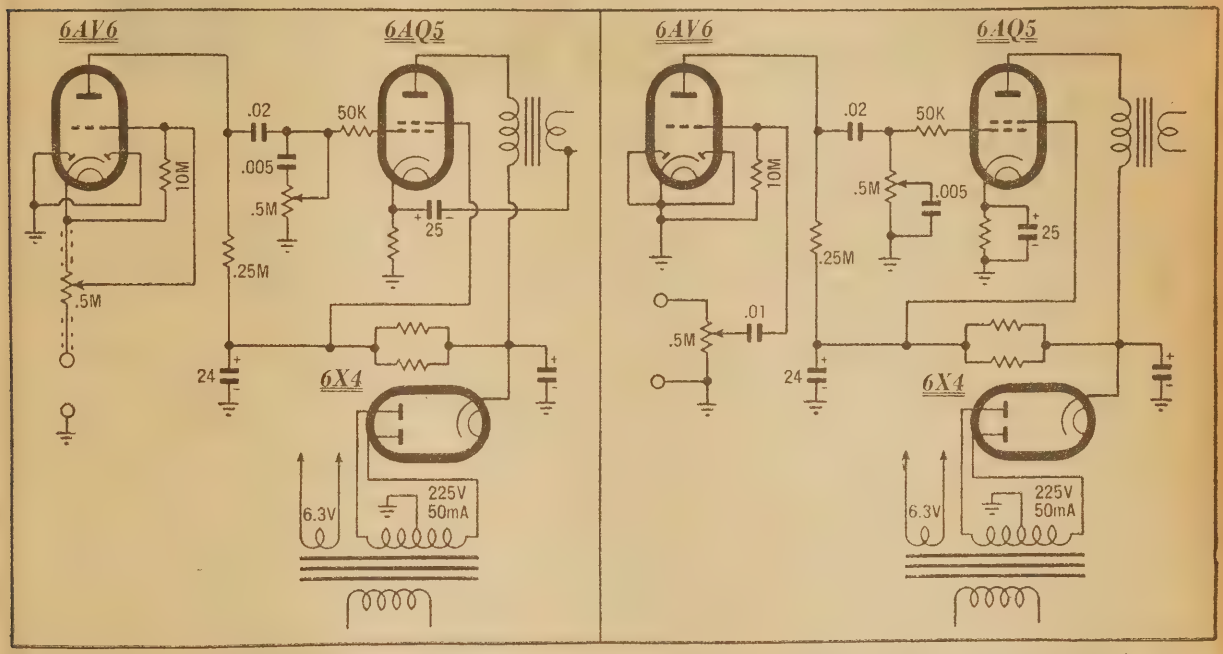


With sapphire stylus — Price £4/9/6
With Diamond stylus — Price £10/17/6

Australian Agents

AMPLION (A/SIA) PTY. LTD.
101 Pyrmont Bridge Road, Camperdown,
SYDNEY, N.S.W.

Here's your answer, Tom!



The circuits discussed here. On the left is Tom's submitted circuit, and on the right our corrected version.

Our initial query for this month's feature is based on a reader's effort to produce an amplifier for record playing purposes. The circuit he submitted contained several errors which readily explained his dissatisfaction with the final result. Our corrections and comments on these are set out below.

Recently I constructed a 3-valve amplifier using old bits and pieces. It comprises a 6AV6, 6AQ5 and a 6X4, as in the accompanying diagram. Could you advise me of suitable control unit to use, as the present set-up is unsatisfactory for records. Would the control unit, as in the November R. and H., 1955, be suitable, or could you suggest a more suitable one?

The circuit as you have drawn it, Tom, contains a number of errors, which would prevent it operating properly. Correction of these errors should make it sufficiently satisfactory, as not to need a control unit. In any case, there would be no point in adding a control unit without first making these corrections, since the result would still be unsatisfactory.

Take the first error for example. As you have drawn it, the valve does not have a grid or cathode return. To provide it with one, it would be necessary to earth the junction of the grid leak, the cathode and the lower end of the volume control. This could have been a drawing error on your part, but we must assume otherwise, since you have shown the cathode lead as shielded. This shielding could not be justified on a simple earth lead.

As the circuit stands, the only earth return for the cathode current is through the pickup itself. If it is a crystal pickup, it may have already suffered damage.

Our amended circuit shows the necessary correction but even this is not sufficient for the correct operation of this valve. The valve is apparently intended to function as a grid leak biased amplifier and, as such, requires a grid return through a D.C. resistance of not less than 10 meg.

Placing the resistance of the volume control in parallel with the grid leak would lower the total resistance considerably, thus defeating the purpose of the 10 meg grid resistor.

Interposing a capacitor between the moving arm of the volume control and the grid will isolate the grid leak and the volume control with respect to D.C. but will transmit the audio signal to the grid.

One further thought arises from this, Tom. This capacitor would not be necessary if the valve was operating with cathode bias. In that case the value of the grid return would not be critical and could be provided by the volume control.

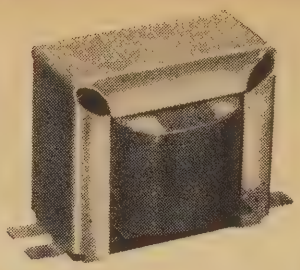
A second major error is in the tone control circuit at the grid of the output valve. As it stands, the circuit is nothing more than a crude volume control, the capacitor in series with the potentiometer being ineffective since it is shorted out by the moving arm.

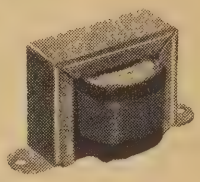
The correct arrangement is shown in our amended circuit. The tone control potentiometer occupies the same general position but it is so wired that adjustment of the moving contact does not short the grid to earth in any position as it does in your original circuit, Tom. What it does, rather, is to introduce the 005 mfd. capacitor between grid and earth, bypassing the higher frequencies and, therefore, acting as a treble tone control.

The 47k is not strictly necessary with

FERGUSON

TRANSISTOR TRANSFORMERS





FERGUSON offer a range of TRANSISTOR DRIVER and OUTPUT transformers designed to meet requirements by manufacturers and home builders of equipment using currently available transistors.

These transformers feature sturdy plated steel wrap-over brackets, firmly crimped to the core Tabs on the brackets are firmly crimped under the core, providing a rigid assembly. Leads are firmly anchored, and the entire assembly is thoroughly wax impregnated.

FERGUSON TRANSISTOR TRANSFORMERS

TYPE No.	Application	Nominal Impedance—ohms		Nominal Power
		Primary	Secondary	
TRD 107	Driver	3000	1300 C.T.	—
TRD 108	Driver	3000	2000 C.T.	—
TRD 117	Driver	420 C.T.	105 C.T.	500 mW
TRS 105	Output	33 C.T.	15	10 watts
TRS 119	Output	33 C.T.	500, 250, 125	10 watts
TRS 108	Output	300 C.T.	3.5	500 mW
TRS 109	Output	375 C.T.	3.5	500 mW
TRS 107	Output	420 C.T.	3.5	500 mW

TYPICAL APPLICATIONS

EQUIPMENT	DRIVER	OUTPUT
Telephone Amplifier—R.T. & H. April, 1958	TRD108	TRS108
Intercom. Amplifier—R.T. & H. June, 1958	TRD108	TRS108
Transporta Six—R.T. & H. August, 1958	TRD108	TRS109
Transportagram Six—R.T. & H. October, 1958	TRD108	TRS109
Transporta Seven—R.T. & H. February, 1959	TRD108	TRS109
Three Transistor Mantel—R.T & H. March, 1959	Not Used	TRS109
RCS 6 Transistor Portable Receiver	TRD108	TRS109
RCS 7 Transistor Portable Receiver	TRD108	TRS109
RCS Transistor Portables—RCA Transistors	TRD107	TRS108
500 mW Amplifier } Philips Miniwatt	TRD108	TRS107
10W Amplifier } Journal Vol. 1, No. 2	TRD108 and TRD117	TRS105 or TRS119

Available from all leading suppliers throughout Australia

Manufactured by

FERGUSON TRANSFORMERS PTY. LTD.

FERGUSON LANE, CHATSWOOD, N.S.W. JA8491

a moderate gain valve like the 6AQ5 but has been retained.

The final error is in the output stage. As shown, the electrolytic capacitor is not operating as a cathode bypass but as some kind of feedback capacitor. We are quite certain that you have not intended it to be so and suggest that you reconnect the capacitor as shown in the amended circuit.

Current in the cathode circuit varies at an audio rate with signal and would generate a varying voltage through a simple resistor. This, in turn, would cause loss of gain, since the varying cathode voltage tends to offset the original signal. A large capacitor, connected across the resistor, is charged to the average voltage drop. Since it cannot then charge or discharge appreciably at an audio rate, it maintains the cathode voltage substantially constant.

Should you wish to apply some feedback from the output stage to the input stage simply connect a resistor of about 2 megs. between the two plates. In your case this would be the safest approach as it would not include the output transformer in the feedback loop.

★ ★ ★

Would it be possible to add an AVC system to your transistor receiver of the December 1958 issue?

It seems to us that we have answered this one before. Nevertheless here we go again.

It is impractical to add AVC to any simple regenerative receiver whether valve or transistor operated.

Firstly, Tom, an AVC system pre-supposes that a receiver has a lot of reserve gain, so that it is able to play weak stations at substantially the same volume as you want to receive the strong ones. The full gain is used automatically in one case and limited in the other.

While simple regenerative sets may receive distant stations, they are usually relatively weak and the set simply cannot amplify them to the full desired volume. There is little basis on which an AVC system can operate.

Again, there is the matter of generating and applying the AVC, and this is no less of a problem in a simple set. There is, in any case, a danger that AVC applied to a regenerative receiver may complicate and confuse the operation of the regeneration control.

★ ★ ★

I have recently built an amplifier and am having trouble with motorboating. Can you help me?

This is another question which has been discussed previously, but it may be well worthwhile to answer it again.

Most radio constructors have experienced this trouble at one time or another. Although stubborn at times, there is nothing mysterious about the effect. It can generally be traced to unwanted coupling between stages via the common power supply.

When the receiver or amplifier is switched on, some random impulse reaches the grid of the output valve. Since this valve cannot differentiate between noise and music, it amplifies the noise and produces a variation in its plate current.

Almost all power supplies are sensitive to variations in the current drain, so that the impulse to the output valve is reflected as a tiny variation in the high tension voltage.

This variation is, in turn, felt by the preceding stages, and they amplify it and feed it back to the output valve. The output valve then proceeds to produce a bigger and better impulse, and if conditions are favourable the whole amplifier bursts into oscillation.

The frequency of the oscillation will usually be quite low, due to the high values of inductance and capacitance in the power supply.

It would be a very expensive business to produce an AC supply completely insensitive to current variations. The normal course is to keep the equivalent resistance of all components in the power supply to a practical minimum and to use large value filter capacitors, in order to secure reasonable regulation.

Partly run-down batteries exhibit poor regulation and a set which is perfectly stable on fresh batteries may develop motorboating on partially run-down batteries. To prevent this and to extend the useful life of the batteries, it is customary to connect an electrolytic of about 8 mfd from the high tension line to earth.

The most practical and the standard approach to prevent variations in the high tension from affecting earlier stages is to use a "decoupling" circuit.

Instead of running the first audio plate resistor directly to the high tension line it is customary to connect a resistor of several thousand ohms in series with the supply end and to bypass the junction with an electrolytic capacitor of 8 mfd or higher.

Decoupling is most effective when applied to the first stage of the audio amplifier, and if there are several stages in all the first two are frequently fed from the same decoupling network.

Trouble is most likely to occur in an amplifier with high gain, and that is one of the reasons why the audio section of ordinary receivers is generally limited to two stages.

In a receiver, motorboating is sometimes produced as a result of interaction between the plate current of the output valve and the screen voltage of the converter or one of the high frequency amplifiers. Here, again, the usual approach is to provide some form of decoupling.

Finally, motorboating can be caused by some of the RF signal voltage getting into the audio amplifier. It is amplified and re-radiated from the wiring and loudspeaker leads to the aerial circuit. The usual cure for this is to install a small bypass capacitor from the plate of the detector or one or more of the audio valves.

★ ★ ★

I wish to connect four speakers to a pushpull amplifier. How can I do this?

A rather broad question, Tom, as you have failed to indicate the purpose of the four speakers. However, the query does give us an opportunity for a general discussion on the subject, which we feel certain will contain your answer.

First of all, the same rules apply to a multiple speaker installation, whether the amplifier is single-ended or push-pull. The only difference is usually that speakers connected to the single-ended amplifier need not be capable of handling as much power as those connected to a higher-powered push-pull unit.

Multiple speaker installations may serve a number of purposes. They may be connected in parallel to share the output of an amplifier, either to dis-

(Continued on Page 123)

Stocktaking Clearance!

AT BARGAIN PRICES

ALPHA ROT. SWITCHES
Brand new at half price.
Dble. Pole. Dble. Throw **7/6**
Dble Pole. Single Throw **5/-**

PUSH PULL SWITCHES
High grade Auto type. **3/6**

I.R.C. RESISTORS
BT1, large 1 watt in 1 meg. only. per doz. **2/-**

DIAL LAMPS
6.3 volt M.E.S. per doz. **6/-**

CONDENSERS
A.W.A. Moulded mica types assorted values. per doz. **1/-**

FUSE HOLDERS
Bakelite panel mounting front loading. **2/-**

MICROPHONES
Miniature carbon inserts **2/-**

SWITCH OUTLETS
Combination flush switch & 3 pin outlet. **3/6**

SHIELDED HOOK-UP
Best quality normal size tinned shielding. per yd. **6d**

PERF. ALUMINIUM
Still some available. Size 9½" x 5". 6 for **2/6**

D.C.C. WIRE
22 gauge white D.C.C. wire approx 150 ft reels. **3/-**

JACKS
Standard P.M.G. Tpe. Single circuit. **6d.**

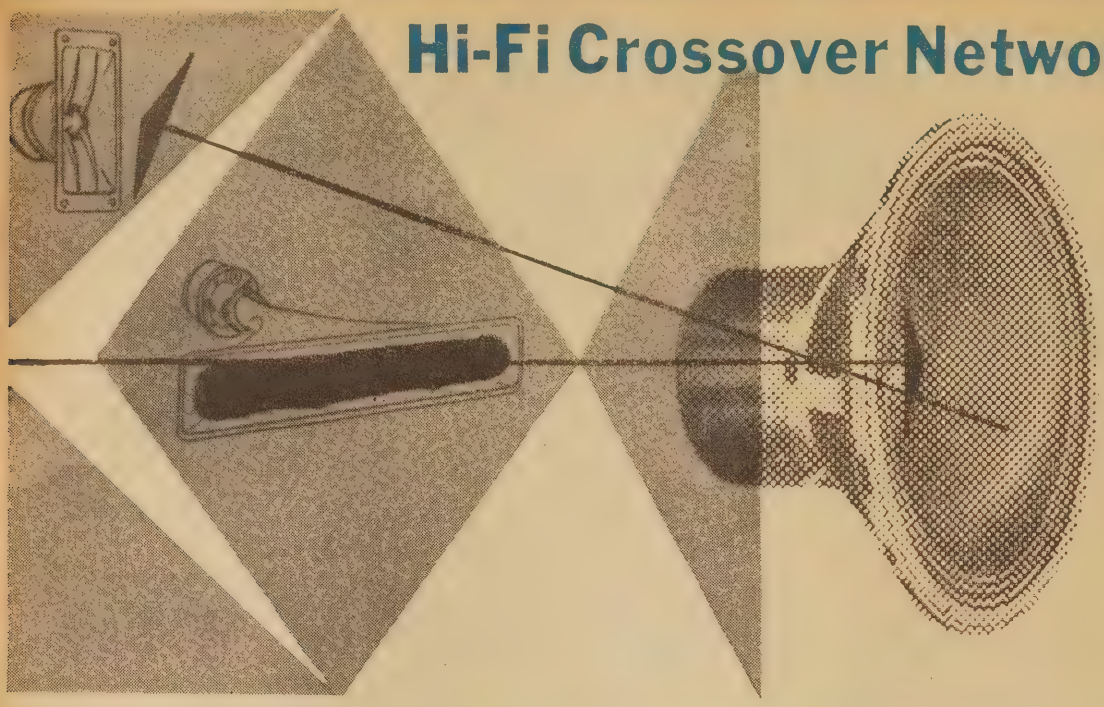
PLEASE ADD POSTAGE TO ALL MAIL ORDERS

PRICE'S RADIO

5-6 ANGEL PLACE SYDNEY

Hi-Fi Crossover Networks

General Principles



By Abraham B. Cohen and Paul D. Cohen

Things you should know about a popular method of feeding multiple loud speaker systems.

AUDIO dividing networks are essential components that ensure the proper functioning of multi-speaker systems.

A well-designed audio dividing network, or crossover network as it is usually called, performs two functions.

First, it is a traffic policeman that directs the various parts of the audio spectrum to the specialised speakers which are best able to handle specific bands such as the lows and highs. The secondary function of the crossover network is to protect the delicate tweeter mechanisms from low-frequency overload.

The end **result** of these combined functions is better utilisation of audio power available from the amplifier, cleaner reproduced sound from the loudspeaker and more direct control over what comes out of the loudspeakers.

There are simple networks and there are complex networks, but they are all easily understandable when approached in a basic fashion.

A simple and quick recapitulation of the principles behind the network function will help the builder decide what network he should construct for his system.

Networks, of course, are used with multi-speaker systems. The simplest multi-speaker system consists of a woofer for the reproduction of low frequencies and a tweeter for the reproduction of high frequencies.

Although it would be unrealistic to connect two components such as a woofer and a tweeter directly to an amplifier without benefit of a network, we will do just that to illustrate what happens to the overall system; then we shall progressively add network elements to the system and observe their effect upon performance.

SIMPLE CONNECTION

In Fig. 1 we have connected a woofer and a tweeter directly across a 10-watt amplifier. Assuming that the amplifier is a good high-fidelity type, we may then expect that it will have full-frequency-range output. Under this condition, the full-frequency range will be fed **equally to both the woofer and tweeter.** If both speakers are of the same impedance, the woofer will get half the power and the tweeter will get the other half. But in each case, the woofer and the tweeter will both receive the same full-frequency range.

Under this condition, half of the high-frequency power available from the amplifier will appear at the voice-coil terminals of the woofer. But, being a woofer, it will not be able to reproduce these high frequencies. Consequently, all the high-frequency power that is fed to the woofer (half of the total high-frequency power) is entirely wasted.

At the tweeter terminals we find a similar condition of power available but with different results. Since half of the amplifier high-frequency power has already been lost in the woofer, the tweeter already has two strikes against it.

Only half of the high-frequency power from the amplifier is available to the speaker to be reproduced as useful sound. Of equal importance is the fact that half the amplifier's **low** frequency power also finds itself at the tweeter terminals. Naturally this represents a waste of half the total low-frequency power that would normally go to the woofer. Since the tweeter cannot reproduce the low frequencies, then the lows that find themselves at the tweeter are a total loss as far as reproduction is concerned.

DANGER TO TWEETER

Of equal importance is the fact that the tweeter itself may become, physically, a total loss under these conditions Tweeters are invariably small and delicately made so that the last drop of efficiency may be extracted from the feeble high-frequency signals. Tweeters are just not built to handle heavy low-frequency signals that should normally go to the woofer, either from a power handling capacity or from a diaphragm excursion standpoint.

It might not take more than a few moments of good, loud playing of a system without a network, such as is shown in Fig. 1, to destroy the tweeter. Thus, even if one wanted to start a system in its simplest form, the use of some type of network is absolutely essential if only as far as tweeter life expectancy is concerned.

The simplest way to protect the tweeter against low frequencies is by inserting a capacitor in its circuit—a procedure which would normally block low frequencies. In this case, as in Fig. 2, we get two effects for the price of one. Destructive low frequencies are kept out of the tweeter; and a **high-pass** filter effect is obtained.

Actually, it is this high-frequency passband effect that prevents the transference of the low frequencies into the tweeter. The passband of the capacitor may be chosen to coincide with the actual high-frequency output of the tweeter itself so that only those frequencies that the tweeter will eventually reproduce will get into the tweeter.

The effect of this simplest type of "network" is the conservation of all the low-frequency power for utilisation by the

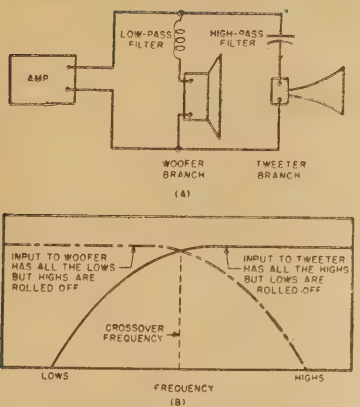


Fig. 3. Two-way network channels lows and highs to woofer and tweeter respectively.

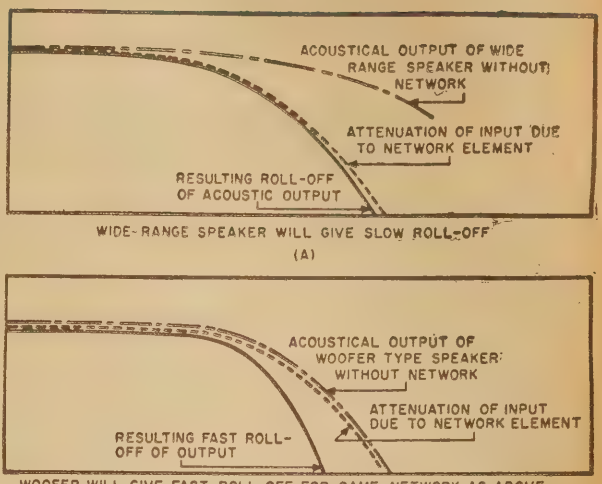

ACOUSTICAL OUTPUT OF WIDE RANGE SPEAKER WITHOUT NETWORK
ATTENUATION OF INPUT DUE TO NETWORK ELEMENT
RESULTING ROLL-OFF OF ACOUSTIC OUTPUT
WIDE-RANGE SPEAKER WILL GIVE SLOW ROLL-OFF
(A)
ACOUSTICAL OUTPUT OF WOOFER TYPE SPEAKER WITHOUT NETWORK
ATTENUATION OF INPUT DUE TO NETWORK ELEMENT
RESULTING FAST ROLL-OFF OF OUTPUT
WOOFER WILL GIVE FAST ROLL-OFF FOR SAME NETWORK AS ABOVE
(B)

Fig. 4. The over-all system performance will be a function of both the performance of the loudspeaker and the network characteristic. Note the operation of the system with a wide-range speaker (shown at A) and with a woofer (shown at B.)

woofer and protection for the tweeter against damaging low-frequency power. It should be noticed, however, that in this simple system, since there is nothing in the circuit to prevent high-frequency power from getting into the woofer, **half of the available high-frequency power is still lost in the woofer.**

It would be worthwhile to digress briefly at this point to discuss the effects of such a "high-pass network" on the listening results obtained with this two-way system.

The degree of effectiveness of this type of system in so far as the high frequencies are concerned will be greatest when the main speaker is **poor** in high-frequency response. If the main speaker is truly a woofer, then despite all the high frequencies that are sent into it, it won't reproduce any high-frequency sound.

Consequently, when the tweeter and its high-pass element are subsequently connected across the amplifier, highs will begin to emerge from the system only as a result of the tweeter being connected and there will be a distinct audible difference.

ADDING A SINGLE ELEMENT

On the other hand, there are many cases where a tweeter and a high-pass element are connected, in the fashion just described, to a main speaker which is of the "wide-range" class. This situation will arise where one has originally installed a single speaker system for good overall reproduction and then, at some later date, decides to build "up" from it to a multi-speaker system. Since the original **single** speaker installation is generally a good wide-range unit, it will reproduce high frequencies with fair efficiency and output.

If a tweeter and a simple high-pass element are now connected across this type of speaker, the high frequencies will again split between the main speaker and the tweeter. **Half of the high-frequency power will still be reasonably reproduced by the original speaker** while the other half will go to the tweeter. Thus the increased overall audible effect of adding the tweeter to a speaker which already reproduces highs will not have quite the impact as when connected to a woofer.

To overcome such a condition and to provide true **network** performance that will not only properly channel the various frequencies, but will improve overall cleanness of reproduction, we have to add a single element to the circuit of Fig. 2. Fig. 3 shows a full two-way system with both high- and low-frequency controlling elements: a capacitor in the high-frequency channel to block the low frequencies from the tweeter and a choke in the low-frequency circuit to keep the high frequencies from the woofer. The capacitor is a high-pass element and the choke is a low-pass element. The combination of the two usually referred to as an LC network, provides an electrical crossover function apportioning all the low-frequency power to the **woofer** and all the high-frequency power to the **tweeter.**

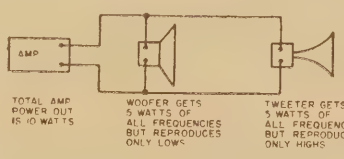
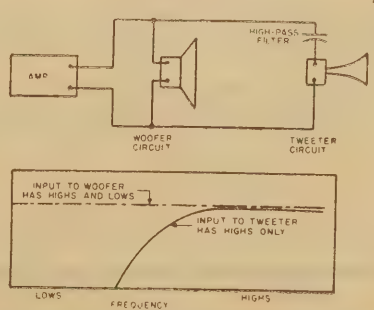

AMP
TOTAL AMP POWER OUT IS 10 WATTS
WOOFER GETS 5 WATTS OF ALL FREQUENCIES BUT REPRODUCES ONLY LOWS
TWEETER GETS 5 WATTS OF ALL FREQUENCIES BUT REPRODUCES ONLY HIGHS

Fig. 1. Lack of network wastes power.

Fig. 2. Simple high-pass filter in tweeter circuit lets only highs into tweeter, and provides tweeter protection, but does not keep high frequencies out of the woofer.



The audible effects of this sort of combination will be readily apparent. In almost all cases there will be fairly clean separation between the bands of sound radiating from the tweeter and the woofer. Where the efficiency levels of the two speakers are of the same order, the output sound from the tweeter and the woofer at the **crossover frequency** will be equal. Above the crossover point the output of the tweeter will be dependent solely upon the performance characteristics of the tweeter itself.

ROLL-OFF CHARACTERISTIC

However, as far as the woofer is concerned, its output above the crossover point does not simply fall away. See Fig. 4. It will drop off in a manner determined **first** by the output characteristic of the woofer, or main speaker itself, as discussed in the previous paragraphs. Then it will be further attenuated by the "roll-off" characteristic of the high-frequency limiting element (the choke) in the woofer circuit. The converse of this situation will hold for those frequencies below the crossover point. The woofer output will now be determined entirely by the woofer performance characteristic while the tweeter performance will be controlled first by the output characteristic of the tweeter and then additionally modified by how the high-pass frequency element in its circuit rolls off the low frequencies.

As shown in Fig. 4, **the end result of the speaker network combination is a function neither of the network, nor the speakers, but is controlled by both the electrical characteristics of the network and the acoustic output of the speakers.**

How does a two-way network of this LC type provide improved audio performance beyond the simple unit of Fig. 1 without the network? First, complete audio power utilisation from the amplifier is now feasible. If there are a full 10 watts of low frequencies available from the amplifier, they will all go to the woofer and be reproduced there without half of them being wasted in the tweeter. Alternatively, when there are a full 10 watts of high frequencies available from the amplifier, they will all go to the tweeter and be reproduced without half of them being wasted in the woofer. Then, of course, there will be full protection for the tweeter against damaging low frequencies.

However, most important from a performance standpoint is the fact that the full two-way crossover network system will provide considerable improvement (reduction) of the intermodulation dis-

"KITSET SPECIALS"

BUILD IT YOURSELF FOR HALF PRICE

1. S/W CONVERTER 2
2. REINARTZ 3
3. S/W 3 BAND 3
4. ECONOMY 5
5. DUAL WAVE
6. RANGER 6
7. D'XERS 8
8. OVERSEAS 8
9. SKYMASTER 11
10. PORTA-GRAM
11. STEREO-GRAM
12. TWIN 5 STEREO AMP
13. TWIN 10 STEREO AMP
14. 13 WATT STD. AMP
15. 25 WATT P.A. AMP
16. 35 WATT P.A. AMP
17. HI-FI 3 AMP
18. HI-FI 5 AMP
19. MULLARD 3-3 AMP
20. MULLARD 5-10 AMP
21. PLAYMASTER AMP
22. TRANSISTOR 2
23. TRANSISTOR 3
21. TRANSPORTA 6
25. TRANSPORTA 7
26. TRANSPORTAGRAM 6
27. TRANSPORTAGRAM 7
28. Multimeter (1000 ohm/V.)
29. Multimeter (20,000 ohm/volt)
30. PATTERN GENERATOR
31. SWEEP & MARKER
32. V.T.V.M.
33. R/C BRIDGE

JUST RELEASED

Complete kit for completely self contained "10 WATT" transistor amplifier. Ideal for small halls, sports meetings, etc., without the worry of power (A.C.) lines. No more vibrator or long power leads—carry it with you, and set up your P.A. system immediately.

Write for further particulars or call and inspect any of the above kits.

We carry stocks of all standard radio parts including Valves — Record Players and Changers —Speakers — Hi-Fi Output Transformers — Microphones and Inserts — Cartridges — Diodes and Transistors — Meters, etc.

OUR POLICY IS TO SUPPLY 1st QUALITY PARTS AT A REASONABLE PRICE

CALL OR WRITE FOR OUR QUOTATION

SPECIAL

Crystal Microphone

DESK STAND type Complete with lead

ONLY

84/6

ELECTRONIC DEVELOPMENTS

NICHOLAS BUILDINGS,
37 SWANSTON ST., MELBOURNE.
PHONE — 63-5973

SPECIAL

Speakers

8in Wide Range Twin Cone

ONLY

106/-

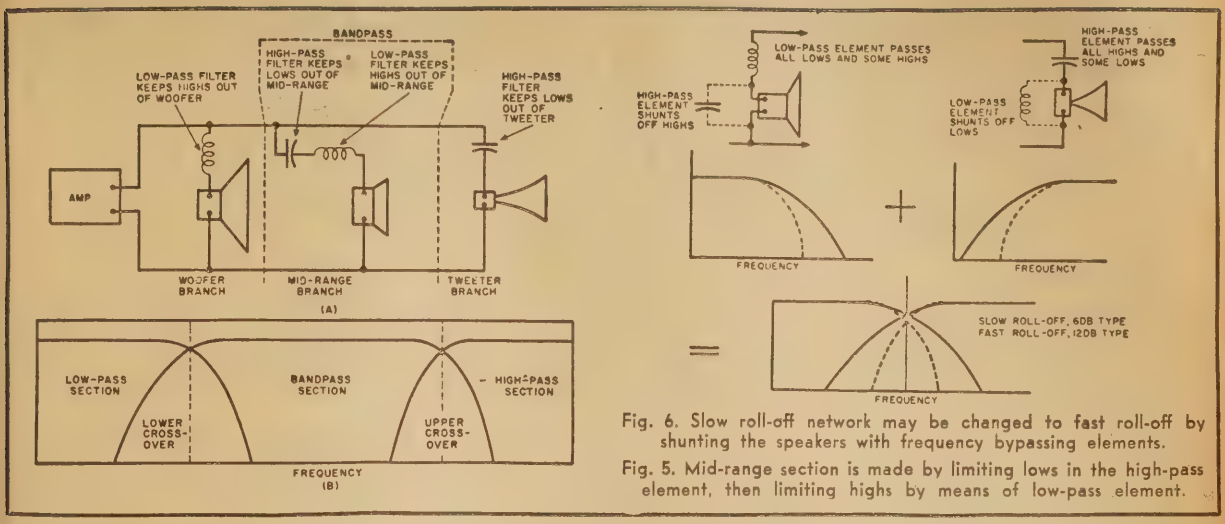


Fig. 6. Slow roll-off network may be changed to fast roll-off by shunting the speakers with frequency bypassing elements.

Fig. 5. Mid-range section is made by limiting lows in the high-pass element, then limiting highs by means of low-pass element.

tortion of the system With the elimination of the highs from the woofer and their being channelled instead to the tweeter, these high frequencies are no longer bounced around by the large excursions of the woofer diaphragm which would be the case if both highs and lows were to come from the main speaker.

By thus providing a separate tweeter diaphragm entirely independent of the more violent excursions of the large woofer diaphragm, considerable reduction in intermodulation distortion is possible, resulting in overall cleaner sound

BATTLING THE BEAM

When frequency division of this sort is practised it is possible to overcome another defect of single-speaker operation, namely high-frequency beaming. In any large speaker, such as a typical 12in or, especially, a 15in unit the high frequencies tend to concentrate in a rather sharp beam in front of the speaker and high-frequency response over a wide listening angle is thus deteriorated

When, however, the highs are not reproduced by the large cone but are instead reproduced by a separate branch, then wide-angle dispersion of the high frequencies may be obtained, either through the use of dispersing type horn tweeters or a bent array of cone-type tweeters.

Level control of the treble frequencies may also be easily accomplished now that they have a channel of their own Such controls are referred to as "brilliance" controls. They raise or lower the entire **plateau** of the tweeter band, thus maintaining the full-frequency range of the tweeter despite the overall output level of the unit.

In summary, a two-way system with full two-way network provides complete utilisation of audio power, reduction of intermodulation distortion, improvement in high-frequency spatial response, treble balancing control, and complete protection of the tweeter against low-frequency damage or burn-out.

The principles of the two-way network may be readily extended to the popular three-way system. Such a system comprises a woofer, a mid-range unit, and a tweeter—speakers which reproduce, correspondingly, the low frequencies, the middle frequencies and the treble frequencies. The same general attributes that were found for the two-way network system are now applicable to the three-way system but with more definition of detail. Obviously, with three-band operation, the separation of the high frequencies from the lows is more efficiently accomplished and more readily audible.

Where in the two-way system, for instance, a crossover of 2000 cps may have been chosen, in the three-way system an upper crossover of 5000 cps may be utilised. Those frequencies from 5,000 cps down to perhaps 350 cps would be carried by the mid-range unit, while below that all the low frequencies would come from the woofer. With this sort of separation, there is no question at all as to which band is carried by the woofer and which by the tweeter.

Audibly, the difference between the woofer cutting off at 350 cps and the tweeter starting at 5,000 cps is as clear cut as night and day. The mid-range unit, bridging these two extremes, has a characteristic personality all its own, again very distinct from the other two branches.

Psychological use is made of the mid-range tonal quality by referring to it as "presence." There are many who feel that reducing the level of the mid-range unit makes the performer recede somewhat in the background, while raising the mid-range level brings him forward —or increases his "presence." This controlling feature of mid-range "presence," along with the treble "brilliance" control, obviously makes the three-way system more versatile than the two-way set-up.

LESS INTERMODULATION

Since there is greater separation of the frequency bands in the three-way system than in the two-way system, we should expect further reduction of intermodulation distortion.

The filtering elements for a three-way network are actually a combination of the principles used in the design of two-way networks. The frequency controlling elements are, in the mid-range case, a capacitor to limit the low-frequency input to the speaker unit, in series with a choke to subsequently limit the high-frequency input to the same unit, as shown in Fig. 5. In this instance, the mid-range section is a **bandpass** type of filter, whereas the low-frequency section is a **low** pass and the high-frequency section is a **high** pass.

(Continued on Page 127)

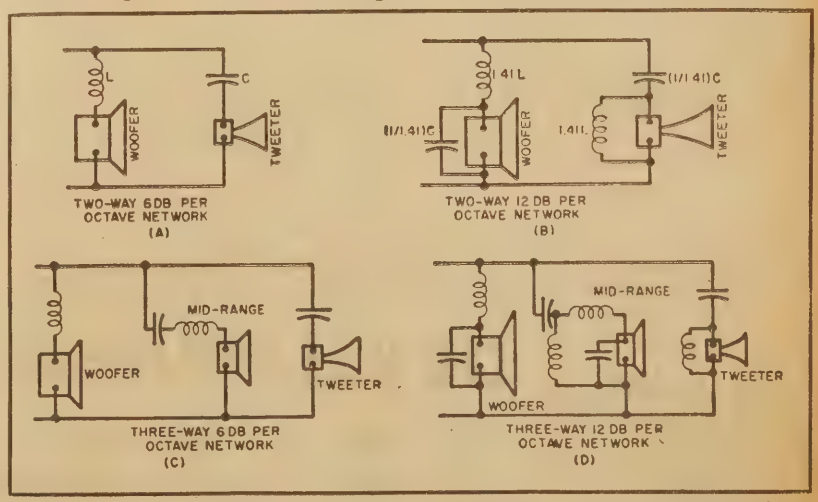


Fig. 7. A 6db network is transformed to a 12db network by adding into each filter circuit an opposite type of filter element. Values will be altered. — See text.

GOOD BALANCE IS VITAL TO STEREO

Reading through our mail, it is surprising how often the same questions seem to occur, notwithstanding the fact that the subject matter has often been covered more than once in various articles from time to time. It would seem that only constant reference will drive home the points which obviously are a source of worry to our readers.

AT the moment stereo is probably the hot spot in the mail.

This is probably natural enough, for although we have been talking about it, in common with many other people, for a long time, new recruits are coming in every day, and they have not absorbed many of the things which, by this time, we would have imagined to be basic.

In a general way, we would emphasise that, as far as equipment goes, matters of quality and performance haven't materially altered with the move towards stereo.

This is because the stereo illusion is not primarily dependent upon the quality classification of the equipment.

STEREO NOT HI-FI

Contrary to the idea that still seems to prevail, and which may be encouraged by salesmen who do not quite appreciate the position, stereo is not an extension of hi-fi, an improvement on hi-fi, nor has it any basic connection with hi-fi.

Hi-fi as we have known it refers to the quality of equipment to reproduce sound without distortion, and with a wide range of frequencies.

It is something which is built-in to pick-ups, amplifiers and loud speakers to make them give superlative sound for the enjoyment of the listener.

Stereo is fundamentally two-channel reproduction, arranged in such a way that two channels, hi-fi or otherwise, are reproduced and heard at the same time to give an impression of width and depth to the reproduction.

Now it is true that, if we are looking for the very best kind of sound, two hi-fi channels will sound better than two which are of inferior quality, because the distortion will still be lower, the frequency range will still be wider, the highs cleaner and the bass more realistic.

These virtues of hi-fi will be carried over into stereo.

WIDE APPLICATION

But the fundamental ability of the stereo system to separate and spread the sound is obtainable in a large degree even from equipment which is no better than that we have been used to employing in ordinary commercial radiograms, which might be pleasant, but are rarely good enough to be called hi-fi.

As a matter of fact, provided the equipment will reproduce reasonably well the range between 100 cycles and 5,000 cycles, the major effect of stereo separation, upon which the ability to mix two separate channels largely depends, will be realised.

And it will be almost as impressive as will that from any other system, judged purely from the aspect of the stereo effect.

Naturally the ability of better equipment to fill in the outlines of sound, to increase its clarity with better highs and round out the lows with better power handling in that region, will very greatly enhance the final result.

Very great strides are now being made in the development of moderately priced equipment which will represent a good compromise between quality and price.

The impetus to fill the gap between the cheap and the good has been brought about by the extra cost of stereo through its employment of a double channel, and the desire to keep it within the price of the average buyer.

Amplifiers in the middle road have gone back in many cases to single-ended designs, and the fact that there are two of them giving roughly the effective sound we were used to with a single channel has largely offset the extra distortion with this circuit, but it does represent a weak spot.

LOUDSPEAKERS

In the loudspeaker field, probably more work has been done than anywhere else.

Designers are intent on making better units of small size and fitting them to enclosures which are acceptable in the modern home, and will still give the impression of deep bass.

It is concerning speakers that so many readers are still worried and puzzled about what to do.

Their concern arises largely from the fact that many already have one good speaker, and wonder whether they must buy another and put it in an equally big box to get good stereo.

It would seem that the most important point to watch when adding a second speaker is that, in the range between 100 cycles to 5,000 cycles it has approximately the same frequency characteristics as the present set-up.

Experiment with balancing stereo systems shows that, under good conditions, a change of only a few db in level from one channel to the other can produce a marked shift in presence.

It is too much to expect two speakers, even of the same make, to exhibit exactly symmetrical response curves, but it is not too much to ask that the general shape of the curves in this vital middle region should be the same.

It could quite easily be the case that a difference of 6 or 8 db could exist over considerable portions of the response curve between one speaker and another. We have observed differences as great as this ourselves.

What happens is that, in those portions of the spectrum, there is an apparent switch of presence from one speaker to the other.

If one of the speakers has a much better high frequency response than the other, it is not unusual to hear a voice predominently on one side and the sibilants of speech predominantly on the other.

As a result, the combination of such speakers should in the best of cases be regarded merely as an expedient, and effects of this nature must be endured until matters can be remedied.

It isn't much use taking care to balance pick-up and amplifier channels, if an inbuilt frequency unbalancer occurs in the speaker system.

A good way of appreciating any difference in the high frequency end is to play portion of a record which has appreciable surface noise, or if you can't find one, to use the run-in grooves of a record with the gain well advanced.

Compare the nature of the surface hiss as heard through each speaker.

You will soon be able to pick the one which has a peak in a given spot, and appreciate the vast difference in sound colour from your simulated "white noise" if the speakers are badly matched.

It would, of course, be practicable to adjust cross-over networks if these are used to reduce a response peak in the middle or high region, but this normally needs more than a passing knowledge of filter theory.

But it can be done, and it can be quite effective, particularly in the region between 2000 and 4000 cycles, in which most speakers, particularly the 8in types, frequently show considerable departures from the flat.

USE OF COLUMNS

It is encouraging to note the good result obtained by the use of various types of column speakers, the virtue of which is a small top cross section and consequently less space demand in the room.

These may either be of the type which loads a single unit, or merely houses for two or three small cone speakers which have many advantages when used together in this way.

Some of them are very nice to hear.

But you should remember that stereo has not changed the basic laws of physics.

The things which make for good bass response, in the way of big diaphragms and cabinets haven't changed.

What has changed is the fact that we have two speakers now instead of one, double the power handling capacity in the bass end, and a new kind of sound quality which by its novelty and restfulness helps to make up for many deficiencies.

It is this latter point which actually increased the value of stereo in the moderately priced field.

FROM THE SERVICEMAN WHO TELLS

Last month's story about a faulty power cable produced an almost immediate reaction in the form of another story having, if anything, even more staggering implications. From the service bench I have a story of a TV set with both sound and picture troubles, both due to different causes.

THE April issue had hardly appeared on the news-stand when a colleague, wearing a "you-ain't-heard-nothing yet" kind of expression, handed me a letter and suggested I might like to comment on same. I must admit my first reading of it left me rather staggered.

My colleague is associated with one of our seats of learning, and the letter came to him from one of the organisation's correspondence students in Malaya. It is reproduced in the accompanying panel and I suggest you digest it thoroughly. And, if you are tempted to laugh at the quaint phraseology, just imagine yourself trying to tell a similar story in Hindustani, Chinese, or a similar "foreign" language.

The first point that strikes me about this letter—apart from lengths to which people will go and the risks they will incur in the name of curiosity—is that the writer is obviously very confused on several points. In particular he is confused over the difference between AC and DC on the one hand, and high impedance and low impedance power sources on the other.

I can imagine our friend, having ". . . had electric shock many times," has been lulled into a false sense of security by the comparatively harmless "bites" from the HT line (DC) of typical radio receivers. From this he has formed the quite erroneous theory that this power is harmless—or, at any rate, less powerful—because it is DC.

A MINOR DIFFERENCE

In fact, of course, this is only a minor difference. The main difference is that the impedance of the radio HT line is comparatively high, thus providing a measure of protection, while the impedance of the power mains is low; so low that the current flow is determined almost entirely by the resistance of the body. If good contact is made to both sides of the circuit the resultant flow is dangerously high.

(Although not mentioned, it is obvious that our student must inadvertently have made contact with some earthed object, say a metal switch cover, in order to receive this kind of shock. Otherwise the rubber shoes should have provided adequate protection.)

The other point concerns the difference between AC and DC in regard to "throwing" or "holding" the victim and there appears to be a fair amount of misconception on this point also, not only by this student, but by other people as well.

The rather bald statement, so often heard, that AC will throw a victim clear while DC will hold him appears to me as being not only a very sweeping and possibly inaccurate one, but a very dangerous one as well. For this much is certain; AC will hold a victim, due to muscular paralysis, just as surely and just as fatally, as will DC.

On the other hand, DC as encountered on the HT line of any ordinary receiver can produce the same violent "throwing" action so often credited to AC; as anyone who has ever had one of these "bites" will surely testify.

In short, so much appears to depend on circumstances and, in particular, whether the victim is in a position to grasp the conductor or not, that the possible difference resulting from whether the power is AC or DC would seem to be very much a second order effect.

In fact, I have heard the above supposed AC/DC difference shifted through 180 degrees, so that it becomes DC that throws the victim, and AC that holds him. So where do we go from here?

MEDICAL ADVICE

I have been trying to obtain some advice from the medical fraternity on this subject, so far without success. However, if I am able to learn anything, I will certainly pass it on in a later issue.

In the meantime, I think we might profitably rewrite the slogan made famous in the days and in the land of Buffalo Bill, when they used to claim: "The only good Indian is a dead one." From where I stand, the only safe power line (AC or DC!) is a dead one.

My service story this month commenced with a brief message to the effect that a particular TV set had completely lost its sound. It sounded like such a routine job that I hardly imagined it would yield any kind of a story, much less of the type that it did.

Now I wish you to explain, and to tell you about the alternating current.

Recently, I made a switchboard like this.

I knew it was very dangerous, although I had electric shock many times. But I want to know how powerful is the alternating current. Before testing I called someone to get ready to switch of the "main switch" in case of anything, and put on a pair of rubber shoes then I open the switch cover, and switch on the lamp.

The lamp is lighting then I put my finger into the switch connecting point. The next moment I am thrown about 10 yards away. And I also dash on and broke a chair.

1. Why the alternating current can throw you and the DC wont, but it will pull you. Why is it?

2. Why after I had the electric shock my body aching for three days?

Hope to hear your answer. Thanking you.

Yours Truly etc.

(Somehow or other I find I have a tendency to dismiss the sound side of a TV set as being relatively insignificant. I imagine this is a natural reaction from the complexity of the video side, which makes the sound section seem simple by comparison—surely a reflection on how one's sense of values can change.)

My first surprise came when the owner ushered me into his lounge room and volunteered the information that, as well as the sound failure, the picture had been "—a bit crook lately—" and would I have a look at this at the same time.

"A bit crook" was a choice understatement. The picture was blurred, riddled with overshoot patterns, and unable to maintain a solid black over any appreciable area. The fine tuning control behaved in a most illogical manner, producing a 5.5 Mc beat pattern at several points throughout its range, yet never "coming good" at any point. All this, and no sound into the bargain.

Mentally registering that the picture trouble almost certainly was mis-alignment I decided to tackle the sound trouble first. The owner had intimated that he wanted to see a particular program that night if at all possible, and obviously was prepared to put up with the poor picture if only I could fix the sound.

Juggling the chassis out of the cabinet I propped it on one side and identified the sound section. A few simple "wet finger" tests established that the audio section was O.K., so I concentrated on the IF section.

This was a fairly standard arrangement, employing two 6AU6's as IF amplifiers and limiter respectively, with a single tuned winding and coupling capacitor between them. A few quick checks here suggested that the whole IF channel was dead, and I reached for the multi-meter to make some routine measurements.

FIRST CHECK

My first check point was the screen of the 1st 6AU6. This read around 150 volts, which seemed a reasonable enough figure for such a circuit. The shock came when I shifted the prod to the plate pin and measured 210 volts. The reason for my surprise was simple; the screen and the plate both derived their voltage from the same decouple point and there was no additional resistance in the screen circuit. How, then, could there possibly be more voltage on the plate than the screen?

On the face of it, the situation was just plain silly. In some mysterious way an extra 60 volts was being added to the circuit between the relevant HT

point and the plate, yet I could see no way in which this could happen.

I went over the circuit again more carefully, just to be quite sure I hadn't overlooked something. I tracked the screen connection back to the decouple point, checked the voltage at that point, traced the circuit out again as far as the plate coil and checked the voltage at this point. It read 150 volts in each case. Yet, on the other side of the coil there was that tantalising 210 volts.

I'm afraid the situation almost rocked me for a few moments. Was I silly? Was the meter silly? Or was the set silly? After a few seconds' thought I rejected the first two suggestions and concentrated on the third. Fairly obviously, something very funny was happening in the set itself.

OSCILLATION

Having reached that decision it didn't take me many more seconds to wake up to what was happening. Unless I was very much mistaken, the particular stage concerned was going into oscillation whenever I placed the meter prod on the plate pin. This would cause the valve to bias itself close to cut-off, thus reducing the drop through the decoupling resistor and producing the mysterious extra 60 volts.

That problem solved, I proceeded to check the other voltage points in the IF section, but without finding anything really significant. At this stage another thought occurred to me. Could the trouble be tied up with the obvious misalignment of the video IF? Was this so bad that the sound plateau and signal had completely vanished?

I decided that this idea, while not impossible, was not very probable. The mis-alignment would have to be almost impossibly bad not to be able to receive some sound, at some setting of the fine tuning control, on at least one channel. And, if it wasn't this, it was most likely a valve.

Since the first 6AU6 apparently was quite capable of oscillating, I ignored it and tried replacing the second one. This done, the sound came forth in fine style, with no indication that the mis-alignment had affected it in any way.

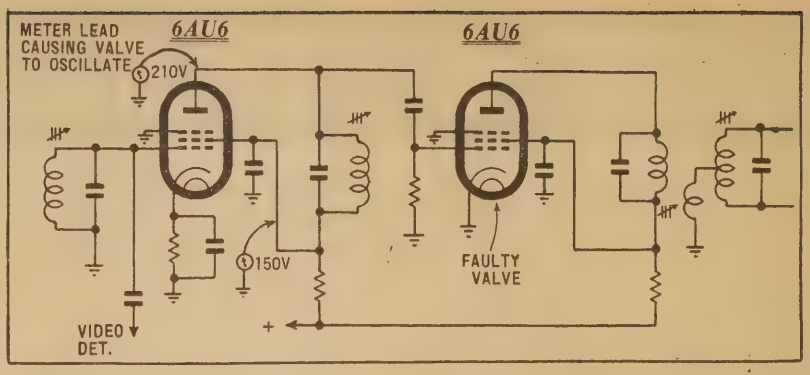
As I said at the beginning, most TV sound faults turn out to be perfectly routine—provided one does not become sidetracked somewhere along the line!

Next, I had to make a decision about the picture. Quite obviously, in order to do the job properly, I would have to take the set back to the shop. However, the owner wasn't keen to lose the set for a week or so and I had to decide whether it was worthwhile trying to improve results on the spot, using only an alignment tool.

ALIGNMENT

Reasoning that there wasn't much to lose with a picture as bad as this one, anyway, I decided to give it a go. The best approach seemed to be that of concentrating on one IF slug, or one IF at the most, so that things would not get too far out of hand in the event that no improvement seemed possible.

The best IF for this purpose seemed to be the last one, a double tuned unit which I knew to be set to give a double hump. I also knew from past experience that it could, like most of its kind, be adjusted to produce a pronounced "tilt" one way or the other. I hoped



Showing how I was trapped by a relatively simple circuit which seemed to defy Ohm's law. How could there possibly be 210 volts on the plate, and only 150 at the HT points? Oscillation, caused by the extra lead on the plate pin was the answer.

that such a tilt might help to balance whatever other fault had occurred.

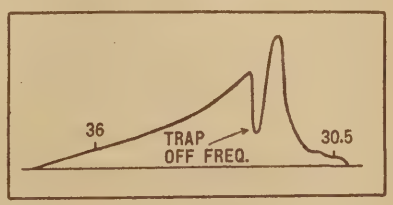
Sure enough, a little careful fiddling with one of the cores resulted in a noticeable improvement, both in the picture itself and the manner in which the fine tuning control behaved. Neither was perfect, of course, but a lot better than before and sufficient to be appreciated by the owner. So I took my leave, having arranged to pick up the set the following week and do the job properly.

And I couldn't help wondering, as I drove home, just how long the owner would have tolerated that horrible picture had not the sound failed and forced his hand. I understand our American colleagues have coined a phrase to cover this type of viewer. They say: "As long as it (the picture) moves, they're happy."

How true, brother, how true!

MOVING TRAP

When I finally set the IF strip up for alignment several days later I found a most interesting situation. Remembering that I had disturbed the original arrangement quite appreciably—and apparently for the better—the wave form which presented itself was still worthy of note. In fact, I made a quick tracing of it so that it could be reproduced for all to see. I can't imagine what it must have looked like before I fiddled with it.



The second fault in the same set was due to mis-alignment. This was the response curve after I had fiddled with it and effected considerable improvement. Goodness knows what it was like before I tackled it.

The main trouble was caused by the trap core in the first IF transformer—normally used to form the sound plateau at 30.5 Mc—and which apparently had "walked" down through the trap winding into the vicinity of the main winding.

This had had two effects. It had shifted the dip caused by the trap to around the 33 Mc mark, putting a "hole" in the middle of the response, and it had detuned the main winding of the transformer and further deformed the curve. Small wonder the picture was so degraded.

By the time I had reset the trap the curve had assumed more reasonable proportions, and it only remained for me to undo the work I had previously done in my effort to correct the condition. Remembering which slug I had used helped considerably, and the curve came good without effort. Apart from a little trimming here and there to straighten out minor irregularities, there was nothing more to do.

However, I did take the precaution of adding some sticky goo to each of the cores, particularly the main offender in the trap, in an effort to prevent a recurrence of the trouble. This is not a particularly difficult job, even after alignment, provided each core is removed and replaced separately, making sure the curve returns to normal before proceeding to the next one.

Finally, I can only comment that there must be an easier and better way to seal cores than most of the schemes used at present. I only wish someone would do something about it.

And to round things off this month, here are a few comments about the type of customer who, armed with little or no knowledge, endeavours to carry out his own radio repairs. (I suppose TV sets will come in for their share in time to come, but most people are too scared to tackle this monster right now.)

READER'S LETTER

I was encouraged in this thought by a letter passed on to me by the Technical Editor, and which he had just received from a country reader. He had answered it and given what help he could (which wasn't much in view of the meagre information available), then passed it over to me with the suggestion that I might like to comment on it.

The essential portion of the letter is as follows:

"It (the problem) concerns a five-valve set, old-timer, with 6A7, 6D6, 6B7, 42 and 80 valves.

"My trouble is, the volume control has no effect on the volume.

"I have tried replacement of the following without any effect. All the valves, the volume control, all the electros, and some of the resistors."

Now, even allowing that the reader is living in some isolated community somewhere out beyond the Black Stump

(as well he might judging from the address), I'm afraid the letter rather staggered me.

Not, I hasten to add, simply because this chap was trying to repair his own set. Plenty of fellows do that, and most servicemen will offer them a helping hand if they look like having any chance of success. And in an isolated community there are plenty of reasons, other than purely economic ones, why people should adopt the "do-it-yourself" attitude.

What, then, is the point?

Simply this. If people want to tackle this job themselves then they should at least have some idea of how to go about it. If they can approach the job logically there is a chance that they may succeed and, even if they don't, they probably will be little worse off than before.

If they can't approach it logically they should leave well alone; otherwise they merely involve themselves in a lot of unncessary expense, waste a lot of time, possibly do some further damage, and get nowhere.

ILLOGICAL APPROACH

And this case, I'm afraid, is a typical example of someone with insufficient knowledge making a completely illogical approach to the problem. The result has been the expenditure, on valves alone, of more than he probably would have paid for a service call, plus the cost of ". . . the volume control, all the electros, and some resistors."

All that, and the set still is not fixed!

Surprisingly enough, many reasonably experienced hobbyists, who should know better, are guilty of almost the same offence. Time and again I am shown letters from readers who have had trouble with a particular project, and which contain the now almost classic phrase, ". . . so I pulled it to bits and built it again, but it still doesn't work."

Why on earth should it? If the device contained a faulty component in the first place, it still will have that faulty component when it is built up a second or even—yes—a third time. And if the builder misread the circuit and made a mistake the first time, and cannot find it by means of normal wiring check, it is ten to one that he will make the same mistake again.

MORE RESTRAINT

So may I enter a plea for a little more restraint in such matters. Tackle a job yourself by all means (I would be the last person to discourage the traditional "give it a go" attitude which is supposed to form part of our Australian way of life), but for goodness sake arm yourself with the necessary knowledge first. Given this, plus a little common sense, you stand a reasonable chance of achieving something. Without it you merely flounder around in the dark without a clue.

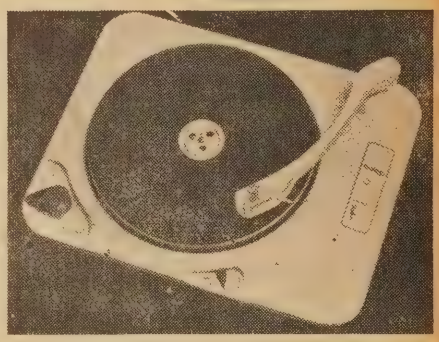
As for the hobbyist who pulls things to pieces again at the drop of a hat, might I suggest that this is, to say the least, rather pointless. After all, the completed job represents a fair amount of hard work and probably is 99 p.c. right anyway. So why not leave it intact as an aid to finding the 1 p.c. which is wrong. You can take my word that it will be far easier to find in the complete units than it will in a box of bits and pieces.

NEW "TD" Stereo-Mono TURNTABLES by THORENS

TD-134L

Manual player, 4 speeds, with the same precision machined, adjustable speed drive as the TD-124 transcription turntable giving absolute minimum wow, rumble and flutter. Integral tone arm, model BL-104 has tracking performance equal to separate arms costing twice as much. Plug in shells with positive locking accommodate all cartridges. Size 15in x 12in, extends 2½in below panel, 3in above.

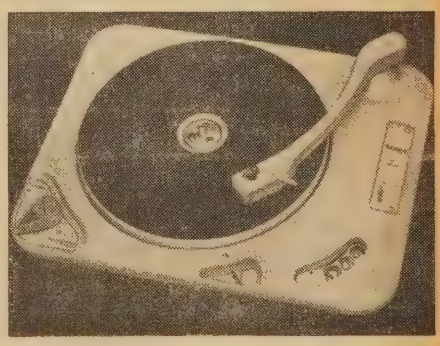
PRICE £43/15/-



TD-184L

Same as TD-134L with semi-automatic operation: One dialling action selects record size, starts motor. Arm literally floats on to record on cushion of air; adjustable piston controls lowering speed. Absolutely no connection between arm and table during playing. Featherweight tip shuts off motor at end of record; lifts arm, disengages idler. Manual control permits shut-off or manual operation.

PRICE £53/15/-



ALSO AVAILABLE

The fabulous TD-124 transcription motor, absolute precision and perfection in record playing at £76.
Pickup arm complete model BL104 £8/12/3.
Remote control lifting device for BL104 arm £3/8/9.
Alternatively the above can be supplied complete as the most outstanding record playing unit TD124L at £85/12/6.

SELECTED CARTRIDGES

For use with the above units, we recommend any of the following genuine G.E. variable reluctance cartridges.
VR11 Monophonic: L.P. and 78 Sapphire. £8/14/6.
CL7: Compatible stereo .7 mil. sapphire. £14.
GC7: Compatible stereo .7 mil. diamond. £22/10/.
GC5: Professional stereo .5 mil. diamond. £26/5/.
These cartridges are all designed for ½in mountings and are unbeatable value at these prices.

Fidelity AE Audio Engineers PTY. LTD.

422-424 KENT STREET, SYDNEY. BX6731

NEW *Releases!*

CLASSIC RADIO TAKE PRIDE IN ANNOUNCING COMPLETE NEW RANGE OF MONAURAL AND STEREOPHONIC EQUIPMENT

Stereophan LIVING SOUND

15 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo, comprising a compact Hi-Fi Stereogram in two units featuring a high gain dual wave tuner with tuned R.F. stage, multi input two channel pre. amplifier with tone controls in one unit and two Mullard 5-10 amplifiers with push-pull outputs and power supply on second chassis **£68/15/-** F.O.R.

Two pair of M.S.P. Jensen speakers or two Rola 12in dual coned speakers supplied. Power output 10 watts per channel (20 watts) frequency response 40 to 12,000 cycles.

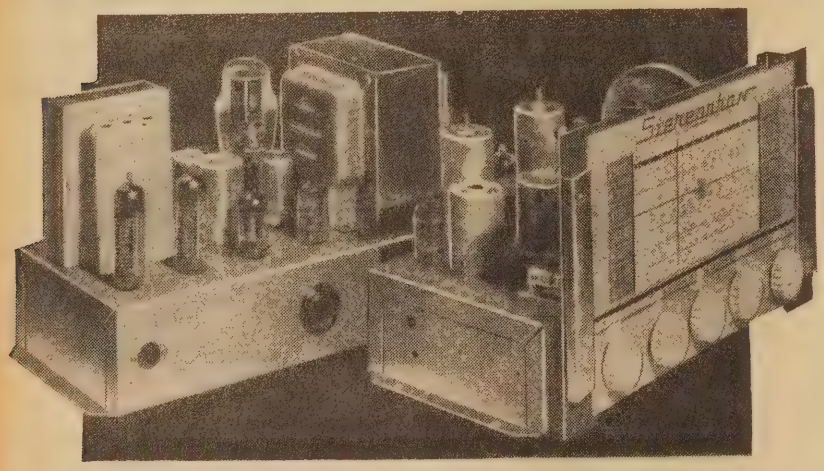
10 VALVE HI-FI STEREOGRAM CHASSIS

Complete stereo unit comprising dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls and two Mullard 3-3 amplifiers, power supply on separate chassis. Supplied with two Rola 8MX speakers. Power output 4 watts per channel. Frequency response 50 to 10,000 cycles. **£48/15/-** F.O.R.

8 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo incorporating the "Mullard 3-3" amplifier circuit with separate bass and treble controls. Output 3 watts per channel. Supplied with two Rola 8MX speakers. Frequency response 50 to 10,000 cycles.

£38/15/- F.O.R.



ALL UNITS INCORPORATE THE NOW FAMOUS "MULLARD" AMPLIFIER & TONE CONTROL CIRCUITS.

SPECIFICATIONS ON OPPOSITE PAGE

A NINE VALVE HIGH-FIDELITY RADIOGRAM CHASSIS

Nine and ten valve chassis incorporate the Mullard 5-10 AMPLIFIER CIRCUIT Frequency response 40-13,000 cycles Max output 10 watts

£42/15/0 F.O.R

A NEW 10 VALVE DUAL WAVE RADIOGRAM CHASSIS

WITH BASS AND TREBLE BOOST

The ideal chassis for those difficult locations where reception is doubtful. Specifications as nine valve unit, but with the addition of high gain tuned R.F. stage giving greater sensitivity and selectivity on both broadcast and short wave bands

£45/15/0 F.O.R

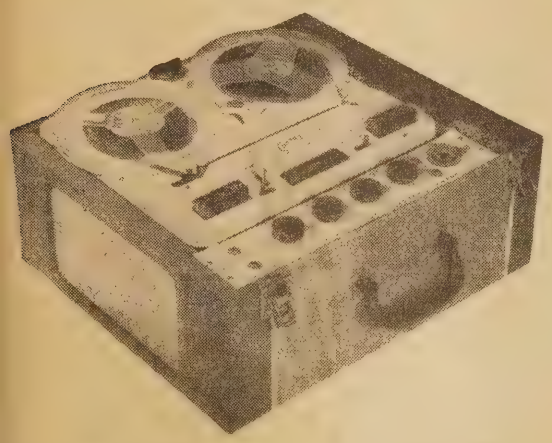
ALL CHASSIS GUARANTEED FOR A PERIOD OF SIX MONTHS. ALL 4 SPEED STEREO RECORD CHANGERS AND PLAYERS STOCKED.

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145

Buying a Tape Recorder?

First see and hear the new Hi-Fi Recorder by Classic incorporating the new Collaro Mark IV Transcription deck. The only deck with ALL these features.



THE COMPLETE UNIT IS SUPPLIED IN ATTRACTIVE AND DURABLE TWO-TONE COVERED CASE COMPLETE WITH ACOS MICROPHONE AND FITTED WITH DUAL ROLA SPEAKERS.

The seven-valve amplifier, including level indicator, incorporates the latest "Mullard" tape recorder circuit equalised to C.C.R. standards giving perfect reproduction from recorded tapes. Record monitoring and outlet to power amplifier. Extension speaker outlet and "magic eye" level indicator. Amplifier is completely shielded and fitted with perspex dress plate to match deck.

- **HIGH FIDELITY**
Heads are double coil wound and will reproduce up to 12,000 c.p.s. at 7½ inches per second. Azimuth adjustments on both impedance "record" and "playback" heads. Output of heads is approximately 5 milli-volts at 1 Kc at 7½ inches per second.
- **INSTANTLY REVERSIBLE**
Instantaneous changes can be made from one track to the other. Fast rewind in either direction
- **CONSTANT TAPE TENSION**
A special Collaro device ensures a constant tension on the tape on the take-up spool as it leaves the capstan.
- **FULLY MECHANICAL**
No solenoids are used in the construction of this Transcriptor. The braking is entirely mechanical.
- **FINISH**
Cream Polystrene cover plate with maroon controls.
- **THREE SPEEDS**
3¾, 7½ and 15 inches per second.
- **FOUR HEADS**
Two "Record/Play-back" and two "Erase" heads are fitted on two different levels and head wear thus halves for any given length of track.
- **TWIN TRACK OPERATION**
One pair of heads for each track. Both top and bottom tracks can be recorded or played back without removing tape.
- **PAUSE CONTROL**
This has the effect of stopping the transit of the tape past the "Record/Play-back" and "Erase" heads and applying the brakes to the spools while leaving all switches and mechanical functions in their selected positions. Typical application is to pause whilst recording to omit speech interposed between musical selections. Control will only work whilst it is held in position.
- **TAPE MEASURING & CALIBRATING DEVICE**
The three digit counter makes the location of any recorded passage the simplest of operations.
- **TRANSCRIPTION TECHNIQUE**
A large diameter flywheel with ground and lapped steelshaft running on a ball at the bottom of long bearing reduces friction and virtually eliminates "wow" and flutter at less than 0.15 to 1.0 per cent.
- **TWO MOTORS**
Each dynamically balanced motor does only one job at a time. Motors never act against each other and are of low wattage input with consequent reduction in heat and wear.

COMPLETE RECORDER WITH MIKE — 84 GNS. f.o.r.

DECK WITH AMPLIFIER, POWER SUPPLY and 6in x 9in SPEAKER, 71 GNS.

AMPLIFIER AND POWER SUPPLY FOR COLLARO DECKS WITH VALVES (7) £34/10/- f.o.r.

SPECIFICATIONS OF OUR NEW HI-FI CHASSIS

NEW:

Ultramodern circuit using nine high gain valves including "magic eye" tuning indicator, Permatuned iron cored coils and intermediates giving excellent interstate reception and a short wave range of 12,000 miles. All valves used are the new Mullard nine pin Innoval series.

NEW:

Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate bass and treble controls giving plus or minus 15 db boost or cut at 50 cycles L.F. and 10,000 H.F., combined with push-pull output with inverse feed-back gives you really high fidelity reproduction from your radio or favourite recordings.

NEW:

Dual speaker combinations using the new Jensen M.S.P. 12PR woofer with matched tweeter and cross-over network giving a frequency response of 40 to 12,000 cycles. If required the Rola 12MX speakers can be supplied (with the 8 valve stereo chassis, two Rola 8MX speakers are supplied). A.W.A. output transformers used on all units.

NEW:

Six position selector switch is incorporated in all chassis with compensation for L.P. recordings and provision for stereo, F.M., or TV tuners and tape recorder.

NEW:

Large calibrated edge-lit dial in perspex (11in x 6in) with main stations of each State in prominent type. Dial fitted with counterweight drive, giving smooth tuning. Dial can be supplied in cream, black or brown with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW:

Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate, overseas and country stations.
All chassis are wired for the fitting of F.M. tuner or tape recorder, special plug being provided on back of chassis, also pick-up terminals and outlet for gramo. motor.
Power switch is fitted to volume control. Audio end of set can be used with TV receiver if required.

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145

NOW! a compact Battery Operate Record Player Unit

PHILIPS NG1012

The ideal player for your own portable unit

Philips now introduce a self-contained battery-operated record player unit that's ideally suited for portable applications. The NG1012 is packed with features and will give big performance from a small space.

£13.5.0

CHECK THESE OUTSTANDING FEATURES

- **COMPLETELY SELF-CONTAINED UNIT**
  Pick-up arm integral with turntable and motor assembly.
- **AUTOMATIC ON/OFF SWITCH**
  Movement of pick-up arm to the right switches on motor; it is automatically switched off at the end of the recording thereby reducing battery drain. This switch arrangement may also be connected to operate an amplifier.
- **GOVERNOR-CONTROLLED MOTOR**
  Ensures constant speed throughout battery life.
- **6 VOLT OPERATION**
  Battery drain—approx. 45 milliamps.
- **SMALL DIMENSIONS**
  Light and compact—makes it ideal for transistor powered portables.
- **4 SPEEDS**
  Plays all record speeds and sizes.
- **TWIN SAPPHIRE STYLUS HIGH FIDELITY PICK-UP HEAD**
  Lightweight pick-up ensures longer record life.
- **SUITABLE FOR STEREO APPLICATIONS.**
  Stereo pick-up head type AG3063 with the counterbalance type NG1023 converts the player for stereo reproduction (see Advert. this issue).

PHILI

P1295.59

PHILIPS ELECTRICAL INDUSTRIES PTY. LTD.
Sydney • Melbourne • Brisbane • Adelaide • Perth • Hobart

TRADE REVIEWS AND RELEASES

ROLA ENCLOSURE FOR STEREO

A problem with stereo for the average man is the fact that two loudspeakers take up more room than one, and as a result he is particularly interested in smaller, neater and inexpensive cabinet designs.

AN answer from Rola, whose lines include some excellent and practical loudspeakers, is this enclosure design which ouses an 8MX loudspeaker. Its outside measurements are pproximately 23 x 14 x 14 inches, and it is supported on etachable legs.

It is a standard type vented enclosure, the dimensions of vhich have been tailored to suit the 8MX, and to give optimum esults from it.

The 8MX is one of the latest additions to the Rola cata- ogue. It has an 8-inch diameter main cone with a sub- diary tweeter cone cemented to the voice coil after the man- er of the 12OX and the 12UX.

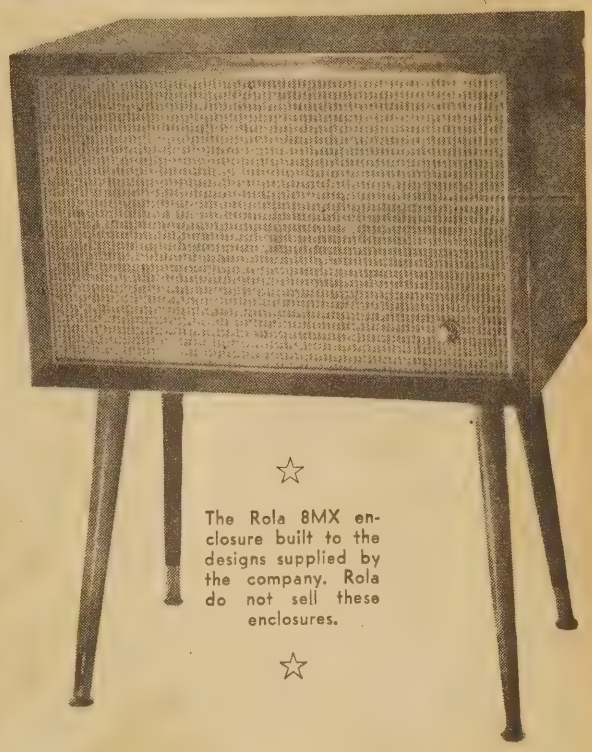
This gives it an improved response at the top end, and he enclosure has been designed to extend the bases as far as ossible beyond the main resonance of about 65 cycles.

On test the speaker system showed a decided rise in the egion of 100 cycles, and a further, although less prominent, ise about 45 cycles. This is the kind of results one would xpect from an enclosure of this kind.

The radiation from the port is most noticeable in the ower range, indicating that it was reinforcing the cone output elow resonance. Used with a well-damped amplifier, these esonances would be substantially reduced in amplitude.

The vent size has obviously been selected to assist in ptimum loading.

In designing enclosures for its speakers, Rola is following he practice now prevalent among most important loudspeaker anufacturers of the world, and this one should represent an xcellent starting point.



The Rola 8MX enclosure built to the designs supplied by the company. Rola do not sell these enclosures.

WARBURTON FRANKI HAVE HEATHKITS

The American Heathkit company is world famous for the excellence of its kits of parts for building home-made electronic equipment. Both in workmanship and design its wide range of instruments is first class.

WARBURTON FRANKI are the Aus- tralian distributors for Heathkits, nd its supplies come through the Heath- t organisation in England.

All the kits are designed for easy as- sembly, and are accompanied by the most elaborate diagrams and instructions which virtually account for every com- ponent and every wire to be put into place in the correct order.

The list of parts is absolutely complete down to the last nut, bolt and hook-up wire.

Although some of the designs are simple, there has been no primary limi- tation to the performance of any unit on these grounds alone.

One extremely popular and efficient member of the family is the Vacuum Tube Voltmeter, the kit of parts for which is shown herewith.

It includes a high-grade meter, finish- ed cabinet and lettered front panel, valves and matching knobs.

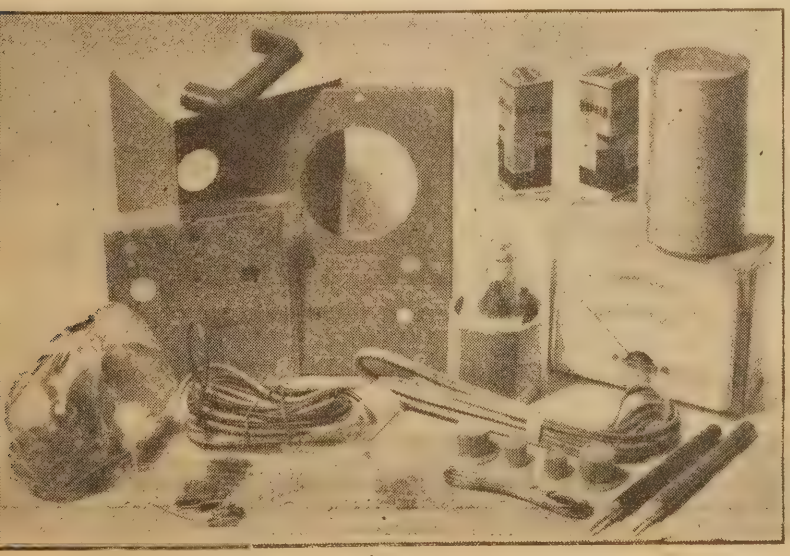
It has a very full set of ranges, in- cluding DC volts to 1,500 and down to 1.5 volts, with an input resistance of 11 megohms and a plus or minus 3 per cent full scale accuracy. AC scales are of the same order, with a frequency response within 1 db from 42 cycles to 7.5 Mc. It also has a wide range of resistance measurements.

It uses a 200 microammeter, and much of the wiring is included on a printed circuit board.

One 12AU7 is used as a meter bridge and a 6AL5 as a full-wave AC recti- fier.

In action it proved itself a thoroughly reliable instrument. After a warm-up period of about three minutes, the meter reading was essentially stable, although one must reset the zero point slightly when changing from range to range.

There is little doubt that Heathkits could become as popular here as they have proved to be overseas.



This is how the Heathkit looks when unpacked for assembly.

You will find that Radiotron has the most comprehensive and reliable range of Australian-made electronic valves.

Years of advanced engineering and exhaustive quality tests have made AWV Radiotron foremost in the field of Australian-made valves.

Sound quality is assured when you insist on Radiotron.

AMALGAMATED WIRELESS VALVE CO. PTY. LTD. 47 YORK STREET, SYDNEY

VC 4.59

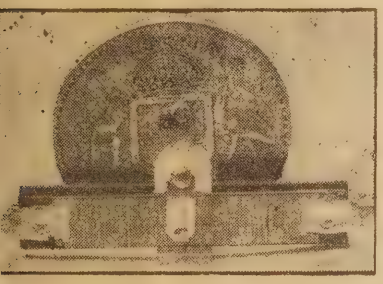
USEFUL STRIP-TYPE POTENTIOMETERS

A novel and very handy item has just been released by Messrs. Watkin Wynne of 21 Falcon Street, Crow's Nest, N.S.W. It is a small slider-type potentiometer.

MANUFACTURED by Naunton, the slider type potentiometer measures 1¼in long, exclusive of lugs and is light enough to be supported by soldering between suitable anchor points.

The element is wound on high grade punching bakelite, while the slider is carried on a nylon block. Friction is sufficient to hold the slider firm but it can be sealed after adjustment, if desired, by a spot of lacquer.

The unit is available in values up to 3K ohms and suggested applications include adjustable bias for transistor output stages, heater CT in high-gain amplifiers, etc.

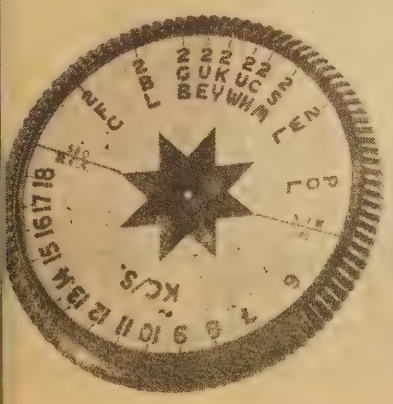


RCS MOULDED DIALS

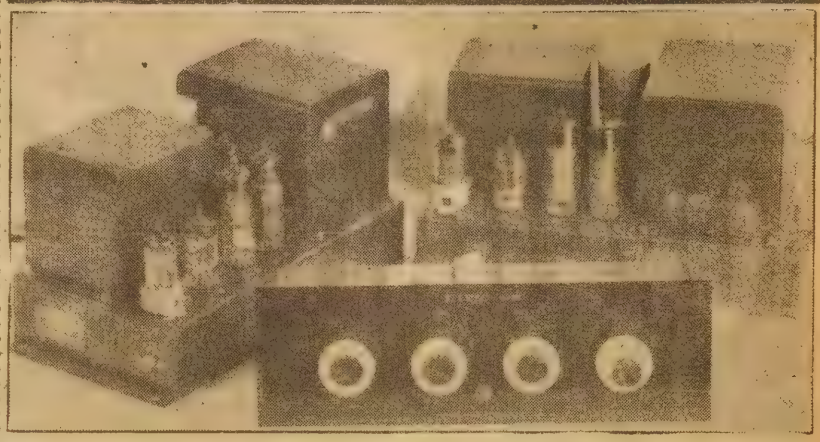
Prospective constructors of small receivers or transistor portables, will be interested in a new moulded dial knob, just produced by RCS Radio.

THE new knob is black in colour, with a heavily knurled edge and faced with an attractive gold transfer. This is protected in turn by a clear plastic overlay, to prevent scratching. The knob is a push-fit on the capacitor shaft, with a spring clip to maintain tension.

Alternative scales will be available and a companion knob for the volume control/off-on switch.



STEREO UNIT FOR TWO AMPLIFIERS



The Hodges unit with two Verdik amplifiers.

Owners of good quality amplifiers are looking for a means of coupling a second and similar amplifier for stereo. Hodges Sound Systems, of Balgowlah, have such a unit for 17 guineas retail.

THIS instrument is a control unit for stereo and monophonic high fidelity reproduction in the home. It combines simplicity with most facilities normally required. Good quality reproduction is assured, and the instrument uses the latest stereo pick-up for a moderate outlay.

The control is designed to operate with two Mullard 5/10 power amplifiers, such as the Verdik Aegis and Grampian, with an input sensitivity of 40 MV. Other amplifiers can be modified.

SPECIFICATIONS:

Input selector (three positions): — Stereo records, monophonic records, radio (mono and stereo).

Bass tone control: Continuously variable with graduated scale 5 db cut to 11 db lift at 50 cycles.

Treble tone control: Continuously variable with graduated scale 10 db cut to 10 db lift. Combined with off/on power switch.

Volume control: A dual control with two knobs serving a double purpose, controlling volume and balance. Enables adjustment for equal output on each channel, and permits the use of dissimilar power amplifiers.

Input sensitivity: 500 MV on both channels for full output.

Finish: Front panel anodised satin black finish with gold lettering. Ivory knobs with gold inlay. Gold hammer enamelled case. The unit is mounted by using a U-shaped rear clamping bracket. Cutout size 9 3/8/2¾.

Dimensions: Front panel 10/3¼; overall 9¼/2 9/16.

NEW LINE OF AUDIO AND LEVEL INDICATORS

MESSRS. Audio Engineers Pty. Ltd. have recently announced the release of an attractive line of audio level indicating meters, one of which is pictured below. They are available as single instruments, or as twin instruments for use with stereo amplifier systems.

The meters incorporate 190 microamp rectifier type VU movements, with an adjustable sensitivity control, variable between 2 and 23 volts. Response is within 1db from 20 cps to 20 Kc. Retail price of the single instrument is £4/17/6 and of the twin £8/7/6. (Audio Engineers Pty. Ltd., 422 Kent Street, Sydney).

A stereo output meter from Audio Engineers.

ONLY **National** HAVE

UPRIGHT or FLAT

POWER TRANSFORMERS FROM 30 mA to 280 mA

TYPE	PRIMARY	mA	A.C. H.T VOLTS	FILAMENT RATINGS			MOUNTING
RADIO							
U or 30/150	230/240	30	150/150		6.3v/1.7a		Midget U or F
U or F40/150	"	40	150/150		6.3v/2a		Upright or Flat
U or F40/285	"	40	285/285	6.3/2a		5v/2a	Upright or Flat
U or F40/325	"	40	325/325	"		"	Upright or Flat
U or F50/225	"	50	225/225		6.3v/2a		Upright or Flat
U or F60/285	"	60	285/285	6.3v/2a		5v/2a	Upright or Flat
U or F60/325	"	60	325/325	"		"	Upright or Flat
U or F60/385	"	60	385/385	"		"	Upright or Flat
U or F80/285	"	80	285/285	6.3v/2a	6.3v/2a	5v/2a	Upright or Flat
U or F80/325	"	80	325/325	"	"	"	Upright or Flat
U or F80/385	"	80	385/385	"	"	"	Upright or Flat
U or F100/285	"	100	285/285	6.3vct/2a	6.3v/2a	5v/2a	Upright or Flat
U or F100/325	"	100	325/325	"	"	"	Upright or Flat
U or F100/385	"	100	385/385	6.3vct/2.5a	6.3v/2a	5v/2a	Upright or Flat
U or F125/285	"	125	285/285	5.3vct/2a	6.3v/2a	5v/2a	Upright or Flat
U or F125/325	"	125	325/325	"	"	"	Upright or Flat
U or F125/385	"	125	385/385	6.3vct/2a	6.3/5a	5v/3a	Upright or Flat
U or F150/285	"	150	285/285	"	"	"	Upright or Flat
U or F150/325	"	150	325/325	"	"	"	Upright or Flat
U or F150/385	"	150	385/385	"	"	"	Upright or Flat
U or F175/425	"	175	425/425	6.3vct/3a	6.3/2a	5/3a	Upright or Flat
U or F200/385	"	200	385/385	6.3vct/3a	6.3/3a	5/3a	Upright or Flat
U or F250/385	"	250	385/385	6.3vct/4a	6.3/3a	5/3a	Upright or Flat

TELEVISION	PRIMARY	mA	A.C. H.T. VOLTS	FILAMENT RATINGS			MOUNTING
TV275/260	200/220/240	275	260/260	6.3v/4a	6.3v/4a	6.3v/5v/3a	Upright or Flat
TV280/210	210/220/240	280	210/210	6.3v/5a	6.3v/5a	6.3v/0.6a	Flat
RH275/295	210/240	275	295/295	12.6vct/4.5a		5v/3a	Upright or Flat

NATIONAL POWER TRANSFORMERS

Manufactured by specialised factory employing the latest winding techniques and embodying the best materials consistent with modern practice. They are used exclusively by many of the largest radio and television manufacturers. Ask your supplier for full details now.

National

FILTER CHOKES

Have many quality features and possess the utmost in filtering qualities. Using the latest winding techniques, and incorporating the best materials, they ensure and maintain the highest possible standard in overall performances. Ask your supplier for full details now.

TYPE	INDUCTANCE in HENRIES	mA	OHMS D.C. RESISTANCE
RADIO			
B.14/60	14	60	520
C.20/60	20	60	500
D.30/60	30	60	600
C.15/80	15	80	430
E.20/80	20	80	300
E.30/80	30	80	380
F.15/100	15	100	300
F.15/125	15	125	250
F.15/150	15	150	200
F.12/175	12	175	160
F.12/200	12	200	125
F.12/250	12	250	133
Television			
RH1/275	1	275	70
TV3/275	3	275	60

Sole Australian Agents—

Wm. J. McLellan & Co. Pty. Ltd.

126 SUSSEX STREET, SYDNEY. BX 1131

DISTRIBUTORS IN ALL STATES

MULLARD 21in 110 deg. TUBE

Mullard-Australia Pty. Ltd., now have available a 21in electrostatic focus picture tube designed for 110 degree deflection. The sample shown was made available by Mullard for review and is known under the type number AW53-88. The retail price is £34-0-0.

The AW53-88 normally operates with an EHT of 16kV. Maximum dimensions of the useful screen area are 19.1in by 15in and the overall depth, including connector is only 14.7in. The last is possible because of the large deflection angle. A similar 17in tube, the AW43-88, may use the same yoke as the AW53-88 and will be available from Mullard shortly.

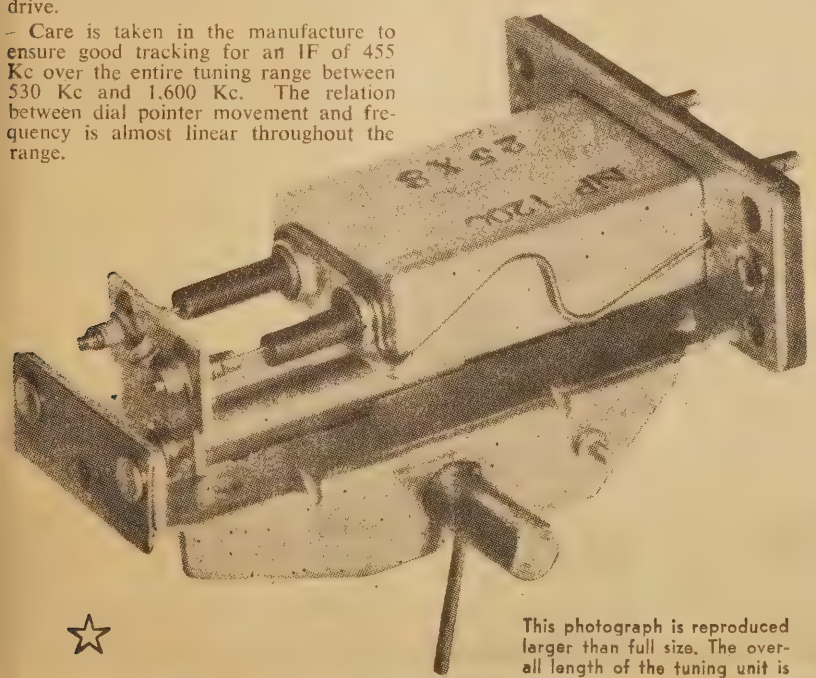
PHILIPS PERMEABILITY TUNING UNIT

An extremely compact car radio could be constructed around the Philips permeability tuner type NP1200 now available. It is also suitable for small domestic receivers.

Two separate ferrite cores fit coaxially in two inductors, one for the aerial circuit and one for the oscillator circuit of a superhet receiver. The cores are fixed to a common carriage plate, which is operated by a rack and pinion drive.

Care is taken in the manufacture to ensure good tracking for an IF of 455 Kc over the entire tuning range between 530 Kc and 1,600 Kc. The relation between dial pointer movement and frequency is almost linear throughout the range.

Good coupling between the aerial and the grid of the mixer valve is assured over the band with the capacitive divider input circuit suggested in the application data. The retail price, including sales tax, £1/15/10.



This photograph is reproduced larger than full size. The overall length of the tuning unit is only 2¾in.

The RADIOMASTER

RADIOGRAM CHASSIS . . .

A great performer on Radio and Records

HIFI MODEL E22 reproduces perfect high treble notes and bass notes without "drumming" or distortion—brings recorded sound to your home as near as possible to the original. A high gain R.F. stage ensures satisfactory long-distance radio reception.
8 valves **£41/15/-**

STEREO MODEL S77 gives glorious three dimensional sound that comes from everywhere in the room. Features include dual treble, bass and volume controls, also balance control. Broadcast and short-wave radio. Seven valves Single chassis. Two speakers.
PRICE **£36/15/-**

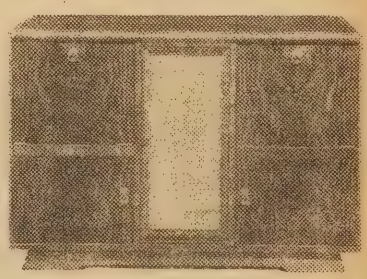
Packing included. Freight extra.

TELEVISION CHASSIS

21in models from £110

Ideal for fringe areas

RADIOGRAM — TV & STEREO CABINETS



Many popular designs are available, including combination Radio-TV-gram. All wanted colours, first-class finish.

New models for Hi-Fi or Stereo incorporate speaker enclosures. TV cabinets can be supplied complete with brackets and straps for picture tube mounting.

ALL TYPES OF FOUR-SPEED & STEREO RADIOGRAM UNITS

WRITE FOR CATALOGUE.

H. B. RADIO PRODUCTS

103-105 Catherine Street, Leichhardt, SYDNEY

Telephone LM5580.

Let's Buy An Argument

I would very much like to have devoted the whole of these columns to the subject of television insurance, as discussed last month. Unfortunately, however, our printing schedule demands that the article be in type before readers have had time to digest and react to last month's offering.

In the meantime, and largely by accident, the said article could hardly have been better timed. On the very day that the South Australian stations began test transmissions and TV sets went on sale, subscribers to our magazine received their copies of the May issue.

I say this without any Machiavellian glee. The remarks were made purely with the intent of making people think and that surely cannot be condemned except by those who have something to gain by mass ignorance and indifference.

In this connection, I was most interested in the reaction of an acquaintance who is a branch manager for one of the local retail groups. Said he:

DEALER'S REACTION

"The more articles you print like that, the more sets we'll sell.

"We give our customers a definite undertaking in black and white as to the exact extent and coverage of our service.

"We don't rely on general clauses, like most of the insurance policies.

"I say go your hardest!"

Whether retailers of this mind reap actually any benefit is another matter, of course. They certainly won't if everyone reacts as did the chief character in another story which was relayed to me.

This man was in the process of buying a television set when the article on insurance hit the streets. His neighbour, who already had certain private reservations on the subject, showed him the article with the simple idea that he would be better able to assess the value of any service or insurance cover which might be involved.

The set buyer showed a modicum of interest, then went back to looking at the pictures. A couple of days later, the neighbour saw him again, and casually asked what he had done about the set he had on trial.

He's signed up for it.

And what about the service and insurance?

Oh, they'd just added that on to the bill!

How much?

About fifteen quid!

Had he checked on the details or had a look at the policy before he signed up?

No. The bloke seemed honest enough, so he hadn't bothered.

How "Australian" can you get?

Then a letter from a reader in Melbourne was short but I'm not so sure "to the point." He simply said:

MELBOURNE READER

"The author of the article, 'Let's Buy an Argument,' in the May issue certainly wound his brain up and let it go with a rush. And where did it finish? In the same position as before.

"You can't get something for nothing!"

I must assure our correspondent that I am quite familiar with his moral (or axiom, whatever it is), but I doubt that it sums up the situation, as it is apparently supposed to do.

What possible connection has it with the fact that large numbers of people are ignorantly paying out money for coverage which is either imaginary or unsecured?

Or that many dealers and servicemen, by ignorance or intent, are augmenting or falsifying service charges to such a degree that insurance companies are having to tighten controls and increase premiums?

That the disillusionment of people who might thus be induced to pay increased premiums for a lot less than they expected to receive in turn, could only result in an enormous amount of ill-will?

These were the main points in my article and its intention, as I said earlier, was to make people think and inquire.

WHAT ELSE?

I don't know what else our correspondent expected. Some magic formula perhaps to allow everybody to show a profit? Or a flight of superb rhetoric which would set off a moral revolution overnight?

No, J.C., I just did my best.

More to the point was a news item in the daily Press stating that an insurance broker, acting on behalf of Lloyds' of London, was planning to raise television premiums immediately by two-thirds.

This company, which allegedly holds the insurance on at least 50 p.c. of Sydney's TV receivers, quoted insurance premiums of £3/12/ and £4/8/ in 1956

by Neville Williams

COLD HEAT, BLACK LIGHT AND NEGATIVE CYCLES

Dear Mr Williams,

We were very much interested to note the reference to contra-polar energy in your magazine. While contra-terrene matter has long been known, first in the science fiction magazines and books and later in the annals of orthodox science with the discovery of the anti-proton and the anti-meson, contra-polar energy, although referred to much earlier in the history of science, has never been as well publicised.

The first reference to contra-polar energy was, I believe, made by one of this publication's associates, Mohammed Ulysses Fips, now called "the oldest employee" of Gernsback Publications in MODERN ELECTRICS for June, 1910.

OFFICE BOY!

Fips was at that time the office boy and his background and training were somewhat clouded in mystery. Some suggested that he came from Mars and, while he always took this as humor, it is notable that his column in the magazine was called "The Martian Spark."

In the June, 1910 issue, The Martian Spark carried a treatise on what he called ultra-electricity, with information on building ultra-batteries and ultra-equipment to use with the batteries.

A few quotes from his article follow: "The surprising part, however, is that when the leads of an ultra-battery are ultra-shorted, they do not become hot but become extremely cold, and if the leads so ultra-shorted are wrapped around a metal tube filled with water, the latter will freeze in a few seconds. Consequently, ultra-electricity cannot be used for heating—only for freezing.

"If one takes hold of the bare strings of a powerful ultra-battery, an extremely pleasant cooling sensation is experienced, not an unpleasant shock."

The article was the first part of a series, but no succeeding parts were ever published. It was significant that the first part stated: "The Government is already utilizing . . ." We refer to the new ultra-electricity. In those days, we had no thoughts of security or secrecy, and nobody ever suspected that a lid might have been clamped on further disclosures of ultra-electricity.

Odd and obscure references to this interesting phenomenon appeared from time to time in the literature, but apparently little further study took place. The next important reference is in the March, 1944 QST, under the title of "The New Contra-Polar Frequency Spectrum" by Sgt. William A. Waldenheim, of the 23rd Academic Squadron, Sioux Falls Air Base, Sioux Falls, South Dakota.

He points out that in the early stages of temperature measurement scientists decided that 32 degrees below the freezing point was as cold as it might ever be expected to get, and marked this point O. Actually we find that absolute O is −273 degrees and, in many parts of the earth, minus temperatures have to be used on either the Centigrade or Fahrenheit scale.

NEGATIVE FREQUENCIES?

The same thing appears to be true of electricity. Sgt. Waldenheim discovered that under certain circumstances current can be obtained in the region of frequencies below O cycles per second. These frequencies he refers to as negacycles, and he points out some alternating current corollaries of the earlier ultra-electricity referred to by Dr Fips.

For example, he shows that resistors are cool if A.C. contra-polar frequencies are applied to them. "A highly effective refrigerator unit could be made consisting of an ordinary heating element subjected to a large flow of contra-polar current."

There was some correspondence in QST on this, but no further important articles for a considerable time. Meanwhile, one researcher, well known in the electronics field in the United States, Lou Garner, had done a considerable amount of work, and submitted a very impressive and serious document well-illustrated with photographs.

It appears that The Proceedings of the IRE was not ready to publish such a revolutionary thing, and our own magazine just couldn't afford the space. It is our custom to print such new departures in the April issue, and our April issue was fully scheduled. In any case, we could not pick it up.

APRIL, 1955

A short synopsis of this paper, was, however, printed in the magazine Popular Electronics in April, 1955. It had some excellent photographs showing the action of negative light, for example, in which the author was changing film in photographic film holders under an ordinary disc lamp powered with contra-polar current.

Since negative light subtracts from the light in the area, the effect is to create absolute darkness (supposing the negative light is unbright enough to counteract the ambient illumination). There was also an excellent photograph of a soldering iron subjected to contra-polar current. It looked almost as if it had been taken from the freezing compartment of a refrigerator.

I trust that you will find these references satisfactory. If not, a few others have been given in the "Popular Electronics" article. The author, whose name is not given in that synopsis, refers to Albert Hull, The Dynatron, the Vacuum Tube Posessing Negative Electrical Resistance, IRE, Volume VI, Page 5, 1918, and E. W. Herold, Negative Resistance and Devices for Obtaining It, IRE, Volume XXIII, Page 1201, 1935.

Sincerely,
"Radio-Electronics"
Fred Shunaman
Managing Editor.

for 17in and 21in receivers respectively.

Later the firm raised its rates to between £6 for the first year and £9 for the fourth. Now the figures are likely to rise to between £10 and £12, which is in line with the rates charged by the smaller companies.

It seems, on the face of it, that new set buyers in the remaining capitals won't be getting any insurance bargains. Maybe that will make them a little more selective.

On another subject, I wonder whether our original correspondent had any idea of the fun he would start when he penned his letter about contra-polar energy. I certainly didn't, when I dropped it into an article, more or less as an aside.

Since then, the discussion has been an amazing conglomeration of fact and fiction.

The "fact" side of it is summed up in a letter from a correspondent at Islington, N.S.W. He writes as follows: "Dear Sir,—

"I remember reading letters and arguments based on (don't look now) Contra-Terrene matter and I would say that you've probably have had enough of it to last a lifetime. Well, I don't intend to make this an argument: it's merely a courtesy letter.

"If it has not already been done, I would like to refer you to a book called, "Selected Lectures in Modern Physics for School Teachers," edited by H. Messel.

"It contains a series of lectures on nuclear energy, cosmic rays, astronomy, transistory (if we may use the word in place of transistor electronics), etc.

"Anyway, one lecture by Mr Schafroth has an account of anti-matter. The description is in the first paragraph about 19 lines from the top, and fills in the rest of the paragraph on page 47. Also a note on page 51, near the end of the page starting with "1. Anti-particles to Hyperons, etc. 2. Anti-particles to L Mesons, etc.

"It is also referred to on the right-hand side of page 50. This book was obtainable at Newcastle Public Lending Library, so it should be obtainable at the Sydney Library, if only for reference.

"So I'll leave you tearing your hair out and gnashing your teeth, while going back to reading my book.

"Before doing so, I'd like to say, while I have the chance, that I enjoy reading your articles every month and am thoroughly pleased with the magazine as a whole.

"Sincerely Yours, B.A."

Well, thanks for the letter, B.A., and for the nice little compliment at the end.

I'm not so sure about your word

VICTORIAN TELE-SERVICE PTY. LTD.

Monthly News Letter

News time again, and in writing this column now as a regular feature, for the information and interest of the enthusiast, we hope that one day our news of the latest developments in electronics available in Australia will become as traditional as "The Serviceman Who Tells" articles.

Already evoking considerable interest is the range of outstanding imported pickup arms, which have now reached us from the manufacturing house of Neat, which uphold the previous quality and finish of the excellent transcription turntables from the same source, mentioned in our previous newsletters. The arms are unique in character and quality and we would recommend anyone seeking a new pickup for stereo or monaural, inspecting this range before buying any normally available pickup, as they can compete with any known brand from England or America. There are five types from which to choose, all labelled around the £15 to £20 mark, and we are pleased to advise that we have a reasonable stock and supply of all types. One type is an elaborate sliding baton universal arm, with counter pivots at the rear of the head and with the arm length being fixed in vertical movement. Another type is viscous damped, which is, of course, following the popular American idea so that the pickup cannot fall or drop, as it is mounted in a static compound fluid, and when dropped can only descend slowly and lightly on to the recording, causing no damage.

We were commissioned recently to build for a private owner a Stereo system which, we think, would at this stage be perhaps the best anywhere in Australia in a private home, and if anyone can do better or has seen better we would very much like to hear about it. The system comprises a "Byer" 77 Stereo Tape Recorder and Play-Back system; a Leak 50 Watt Stereo amplifier and Control Head; "Quad" AM and FM tuners; "Connoisseur" Transcription Turntable and "Ortofon" Stereo pickup, feeding into Twin "Wharfedale" Speaker systems and sand-filled enclosures, all this coupled with an imported automatic "Graetz" Television Receiver. We had to supply, build and install the equipment into three reasonably small cabinets suitable for the layout of a distinctive home.

The results have more than offset the expense and make what we consider to be Australia's outstanding unit in custom building Stereo/TV. This, of course, would be most people's dream unit, and it is gratifying to see one very proud owner, happy with his choice.

P.S. Our heads are not always this high—We also have in stock "PYE" portable Stereo units of excellent value for £54 complete.

Owing to the interest which has been aroused by an earlier brief mention of our Closed Circuit Television equipment, for which we are Victorian Agents, we are this month describing more fully this world famous equipment. Grundig, the German manufacturers, have spent years of development and experimental work in their laboratories to find an answer, pre-prepared, for any contingency which may arise in industry calling on closed circuit television. They have covered the field from inserting television cameras into blast furnaces, to hundreds of fathoms down to the ocean floor.

We can supply one of the cameras in miniature form little larger than a 5Y3 valve, which will automatically crawl up pipes, carry its own illumination and inspecting surfaces, cleaning them as it goes, to miniature cameras the diameter of a 6 x 4 valve and three times the length, which can be dropped down bore holes, and cameras used for the geological examination of mining and the earth's structure. Cameras are available which will operate miles distant from the operator, as if there were a camera man attached. This is done by a simple system of remote control which will pan, tilt, focus or adjust the camera in any direction; at the same time it is completely weather proof and virtually needing no attention.

To order, we have Television cameras small enough to be used for internal surgical work or robust enough to be towed through sewerage pipes. Any of these units may be adapted for three dimensional television or for infra red work, able to view through opaque liquids in the dark or under water. There are cameras which will operate in temperatures to 2,000 degrees Centigrade or with a viewing angle of up to 170 degrees and under illumination conditions not suitable for human vision.

Imagination can run riot as to the fantastic uses of these cameras in everyday life and industry, where it is possible to safeguard human life and remove personnel from dangerous operating areas. This is the field in which closed circuit miniature television excels and we can bring the cost of such high quality equipment to a basic figure of £1,100.

The standard of resolution, definition and reproduction make Grundig system far in excess of what is seen in commercial TV today and those who have attended our showrooms and seen this equipment demonstrated have been visibly staggered by the fantastic results.

We welcome any enquiries, whether simply through interest or with a definite business viewpoint and are only too happy to demonstrate this equipment at any time. Our staff have had wide experience in its practical use and are only too happy to help solve any problems to which you think closed circuit TV may be the answer.

Well, we have gone from Hi-Fi to Industry this month, but next month we hope to be able to devote this column to a full stereo review of available equipment. Note: a new shipment of imported stereo records has just arrived.

Hoping to hear from you, we remain.

Yours sincerely,
VICTORIAN TELE-SERVICE PTY. LTD.

783 Glenhuntly Road,
Glenhuntly.

Telephone
UL1038, UL1039

"transistory," however. To condemn it outright would provide grounds for some unkind person to question my support earlier of the term, "circuitry."

Against all this is a very enlightening letter from Mr Fred Shunaman, Managing Editor of our U.S. contemporary publication, "Radio-Electronics."

He quotes chapter and verse to support my original suggestion that the first letter on this whole subject was based on just such grounds. That much is gratifying.

But I suggest you read on and follow the whole thing through to its illogical occlusion.

What matters it, if, in so doing, you suffer a slight elongation of the tibia?

To Mr Shunaman, I can only say thank you for his generous and diverting contribution.

AND M. ULYSSES FIPPS

Perhaps I might add that if ever the mysterious Mohammed Ulysses Fipps should depart this life and repair to his contra-terrene hunting grounds, no person shows greater promise of being able to write substitute copy than his own Managing Editor.

What a shame if their ultimate demise should be coincident!

Returning to an everyday plane, I have a letter to hand from a correspondent in Virginia, Brisbane, who modestly desires to be known only by his initials J. H.

His letter is a studied effort and my main problem is to know best how to handle it in the purely mechanical sense. If reproduced separately from the answers, it would be difficult to correlate the two. If query and comment are made to follow in order, you may have difficulty in separating one from the other.

We have therefore adopted the course of subdividing the original letter into paragraphs, abbreviated in some cases, and introduced by a subject heading. The comment in reply is identified, in turn.

TEST EQUIPMENT: "Your designs for this get better and better but also more complicated. How about something useful for the novice? Multivibrator style?"

COMMENT: Thanks for the compliment, first of all. It is quite true that our test equipment designs are becoming more ambitious but not because we necessarily wish it that way.

While there are still a lot of "beginners," a large proportion of readers now handle television receivers, complex amateur transmitter and advanced audio equipment which demands advanced test gear for its proper assessment.

While we certainly are not averse to describing simpler gear, when it can be justified, we equally cannot ignore the demands of those who want and need the more ambitious kind. And if we seem to be greying a little and growing a little more stooped, it could have something to do with the necessity of solving the ever-tougher problems, which result in time for each successive press date.

VACUUM TUBE VOLTMETER: "I suggest an instrument even more elementary than the one in the December issue, to measure only high ohms and bias voltages. Can it be done and would the now cheap battery valves or power supply from a radio be practical?"

Comment: Such suggestions tend to break down on close examination. For example, having provided the basic circuitry to measure high ohms and bias voltages, one may as well add the few basic bits and pieces to measure the full range of both. We feel that it represents a better overall economy in both effort and cost.

Then, again, our latest VTVM used a cathode - follower input system, which might seem rather like a luxury. However, it was included to minimise zero shift with range setting with time and with the resistance of the circuit under test. This problem can be of such an order that it may make an over-simplified instrument both difficult to use and misleading.

The alternative approach of using a high sensitivity meter and selected valves has its own obvious problems and is often less effective in the end result.

The need for AC ranges might likewise be queried but our advice would be to omit them from the instrument for the time being but allow for them to be added later when time and funds might permit.

The use of battery valves would pose so many problems that they could not seriously be considered. Disposals type AC valves would be more practical electrically but their greater size and the larger number may mean that the finished instrument would be that much more bulky.

And would the saving be worthwhile?

Other ideas include using an external multimeter on the 1-milliamp range. Ostensibly it would save a meter but think of the nuisance of using it and the complication of unsuitable scales.

Then there's the idea of drawing power supply from an old receiver. What old receiver and what of the problems about too many volts from too large a transformer? And what of the need to centre-tap the supply so that it provides the requisite number of volts positive and negative with respect to earth?

The vital point which emerges from all this is that the boxfull of oddments which a builder might like to use differs in every case. This means that many would-be constructors either have to make their own adaptations still or else spend money to duplicate a second-grade prototype.

Indications seem to be, rather, that most constructors want test equipment that looks the part. This much is evident from the brisk sales of standard cabinets and properly graduated panels. Our tendency has been more to help readers along these lines, while fully realising that many will want to make their own private adaptations.

★ ★ ★

SIMPLE OSCILLATOR: "Something covering 455Kc, 600Kc and 1300Kc by switched or plug-in coils. Again, one or two valves and a parasite power supply. Extreme accuracy is not so important but something elementary made from bits and pieces is better than nothing."

Comment: We did describe a simple oscillator like this some time ago but it did not prove particularly popular. The vital point of the matter is that it is usually easier to provide a tuning capacitor and obtain general coverage, than to fiddle with coils switches and trimmers to get spot frequencies.

The "outrigger" power supply can be a nuisance, in this case for another reason, in that it invites RF radiation and makes it very difficult to reduce the test signal enough in strength for convenient alignment.

Once again, our own feeling is that it is better to encourage proper constructional methods and leave it to individuals to compromise if they must.

★ ★ ★

OUTPUT TRANSFORMERS: "Step circuits and all that. Wouldn't it be nice if a clue to requirements were given by the individual manufacturers. Are purchasers supposed to guess what might suit? It is not practicable to do all those tests. I doubt whether there are more than three or four servicemen in Brisbane with the clues and equipment.

"If manufacturers cannot or will not help, could RT and H perform a real service and suggest suitable circuits for the respective widely used transformers?"

Comment: We agree that a problem exists here. We know it, because so many constructors write to us from time to time, mentioning specific amplifiers and output transformers.

We have, on various occasions, mentioned compensation for different types of transformers in relation to particular amplifier circuits but, not being specifically indexed, such mentions have become lost amidst other general reading.

Even to do this much presents quite serious practical problems. Possibly four manufacturers may be interested in a particular field, with transformers covering output impedances of 2, 3.75, 8 and 15 ohms. Allowing for alternative winding connections, this would involve us in collecting 8 specimen transformers and conducting tests on 16 variations.

But this is only the beginning. Over the years, manufacturers have released dozens of different transformer types, all different in detail and often much too good to discard.

Similarly, we have described many amplifiers, which have appealed to readers for one reason or another, and these are built up with a variety of transformers, some of them post-dating the circuit.

The problem multiplies up, on this scale, to one which is simply too unwieldy to tackle.

Manufacturers are scarcely in a better position, because they would have to build or arrange access to any amplifier which had ever been popular, and this is not confined to our own designs. They would have to wind copies of transformers, obsolete and out of stock, but still being used and used over again by amplifier builders.

Even assuming that the more unlikely combinations were eliminated, the job of tackling the rest would be formidable indeed.

Frankly, I can't see it being done unless some of us start going without meals and sleep.

★ ★ ★

LOUDSPEAKERS: "Recently Mr Williams stated that high impedance speakers were impractical. Congratulations to Philips who apparently paved the way. And didn't they originate the ultra linear circuit, too?"

Comment: I would have to find the actual reference to know the exact wording of the article on high impedance speakers. I very much doubt, however, that I said they were impractical.

I remember discussing them in a general way and pointing out that they were not nearly as attractive a proposition as might appear at first glance. I pointed out the complication of having DC to flow through the voice coil and the fact that centre-tapping was not an automatic answer to the problem.

The fact that a particular manufacturer may have brought out a high impedance speaker is not new, either, because work along this line had been done by at least one local manufacturer with whom I discussed the matter. I was also well aware of current work on so-called single-ended push-pull circuit configurations.

To say any more, I would need to study the previous article and also to know exactly what our correspondent has in his mind by his present reference.

I seriously doubt, however, that there is any need to recant.

As for the ultra-linear circuit, it's pedigree has already been examined in these columns, though it would once again entail a search to locate the exact issue.

As I remember it, the idea dates back to the early thirties, when pentodes were first being put into audio power stages. Two Australians, Chilton and Lackey, put forward the scheme of returning the screen to a tapping on the output transformer.

Some years later, two Americans (Hafler and Geroes was it not?) claimed rather sensational benefits for the scheme in connection with high quality amplifiers, in the magazine "Audio."

We reprinted their article at the time but it took a further couple of years for the audio fraternity to awaken to the fact that the scheme did, in fact, have considerable merit.

Since then, an enormous amount of work has gone into the ultra-linear circuit but it would take a seer to nominate who had done the most and best.

FOREWARNED IS FOREARMED:—

Dear Sir,

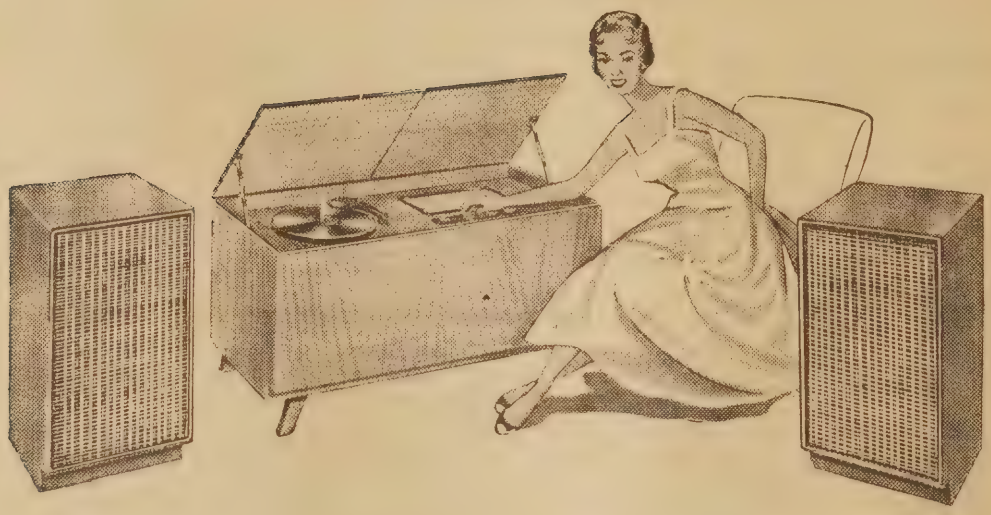
Very many thanks for the illuminating article "Let's Buy an Argument" in this month's R, TV & H.

I read it today, two days after television came over the horizon in South Australia, like the rising sun.

My status? Just an ordinary guy who buys your magazine to have what it offers, and who will be buying a monster in the next month or so. Whether I like it or not.

Yours Faithfully, J.D.C.

PLAYMASTER STEREO &



Now firmly established, Stereophonic Sound is growing tremendously in popularity. True stereo reproduction is achieved when you employ Playmaster Hi-Fidelity equipment. All Playmaster Amplifiers, Control Units and Tuners are "R.T.V. & H." designs by Mr John Moyle. We can supply you with a complete kit of parts to build your own Stereo or Monaural Unit, or we can supply the unit completely wired, tested and ready for instant operation. Whether you build your own or purchase the completely built unit, you receive outstanding quality and performance at a far lower cost than that of similar imported units. The Playmaster range includes three very fine stereo units. They are the Simple Stereo Amplifier ("R.T.V. & H.," July, 1959), the 10 Watt Ultra Linear Stereo Amplifier ("R.T.V. and H.," Jan., 1959), and the Stereo Crystal Control Unit ("R.T.V. & H.," Oct. 1958). A complete range of speakers, player units, and stereo cartridges, is available to suit all Playmasters.

MAKE YOUR OWN HI-FI CABINET

In conjunction with the makers of the well-known "Easybuilt" Furniture Kits, we are happy to release these outstanding basic cabinet kits. There is a kit for a vented speaker enclosure, which is specially designed to accommodate most types of high quality 12in speakers. Provision is made for the addition of an accoustical resistance unit if required. In addition, a kit is available to build your own cabinet to house the player unit and amplifier, together with control unit and even Playmaster Tuner if required. This cabinet has been designed so that the larger Playmaster Units, together with the largest player unit or record changer may be incorporated in the one cabinet equally as well as any of the smaller Playmaster outfits. Provision is made for the addition of tuners on the top control panel. It is essentially a modern cabinet, dignified with the accent on quality throughout. Front edge of the lid is bevelled so that a timber moulding, or a thin strip of formica may be fitted if required. Armchair tuning is a feature of this cabinet, and the short swedish legs give it a most attractive appearance. At the same time, the cabinet is available with longer legs for those who require a higher model.

All Hi-Fi cabinet kits are in solid 7/8in timber, which, when polished, gives a lustrous appearance. They lend themselves equally well to a painted finish. Truly, this is Hi-Fi without tears, quality cabinet work which you can construct yourself at an exceedingly low cost

ELECTRONIC

E. S. & A. BANK BUILDING, 206

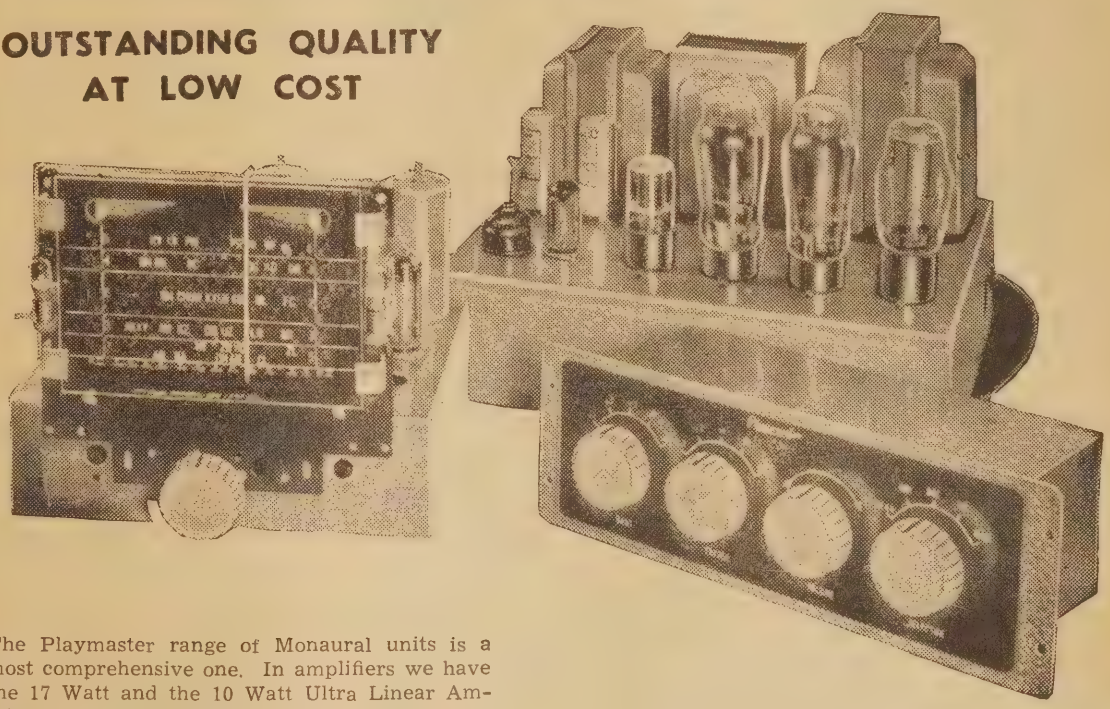
Phones BA489.

HI-FIDELITY

MONAURAL

HIGH QUALITY KITS TO BUILD YOURSELF OR READY WIRED AND TESTED

OUTSTANDING QUALITY AT LOW COST



The Playmaster range of Monaural units is a most comprehensive one. In amplifiers we have the 17 Watt and the 10 Watt Ultra Linear Amplifiers together with their associated Control Units Nos. 4 and 6. For crystal operation, we have the 13 Watt Ultra Linear Amplifier and the 5½ Watt Amplifier, each of which incorporates built-in control units. There is a range of tuners incorporating one for the country man with R.F. stage, and other Hi-Fidelity tuners for local reception, including an F.M. tuner.

The outstanding quality of design and performance of Playmaster Units, plus their exceedingly low cost backed by Electronic Parts, many years of specialisation in the Hi-Fi field, makes Playmaster a must for the descriminating.

SPECIAL—

A COMPLETE HIGH GRADE PLAYMASTR OUTFIT FOR UNDER £50

If you are keen to obtain high fidelity reproduction, something much better than could be expected from even the more expensive radiograms, this genuine Hi-Fi outfit will appeal to you. It comprises Playmaster 5½ Watt Monaural Amplifier (available in kit or completely built), the sensational Magnavox 12 W.R. Twin Cone speaker and latest dual four speed record player, full details are in the Playmaster catalogue.

STOP PRESS . . .

KITS NOW AVAILABLE FOR the Mullard 2—Stereo 2 Amplifier

SEND COUPON NOW

Send coupon, or if you do not wish to cut this page, write for full details of Playmaster Hi-Fidelity equipment, both Stereo and Monaural. This is free and post free to you.

PARTS Pty. Ltd.

BROADWAY. N.S.W. (Opp. GRACE BROS.)
BA4892 BA4893

TO ELECTRONIC PARTS PTY. LTD.

Dear Sirs
Please send me full details of your Playmaster Hi-Fidelity Equipment

Name .....

Addresss .....

OFF THE RECORD — NEWS & REVIEWS

A striking feature about stereo in Australia has been the keen reaction of audiences attending public demonstrations and lectures. I have given a number of these to date, and it's good to see so much honest enthusiasm.

by John Moyle

MY first appearance was nearly twelve months ago, when the Audio Society asked me to give a talk and demonstration of the new discs in History House, and this I was very pleased to do.

What I was not prepared for was the huge roll-up of audio fans, engineers and general public, which packed the hall and overflowed into the street.

The same story has been repeated a number of times in Sydney, and once in Newcastle. Whether they came to hear the lecture or the sound is not quite clear, but I supect the sound won out by a long margin, and, frankly, it was the part of the proceedings which I enjoyed most myself.

GREAT ENTHUSIASM

The last occasion a couple of months ago, when I again appeared for the Audio Society in History House, we reckoned there was a gathering of at least 400 people, and their enthusiasm appeared greater than ever.

Almost daily someone has asked when there will be such another.

Well, in conjunction with the Audio Society, we have arranged to stage our biggest and best evening to date in the Sydney Conservatorium Hall on the evening of Wednesday, June 10, at 8 p.m. sharp.

As I hope it will be the most elaborate, and will call for the most preparation, I have enlisted the aid of my obliging colleagues, so that the program will really be a joint effort by the staff of the magazine.

The hall is much bigger than any we have used so far, and seats about 950 all told, but I have no doubt that enough people will be interested to fill it.

Acoustically, too, it is quite different, but the chances are that the end result will be particularly good.

As these notes are written almost a month before the event, it isn't possible to give firm details of the equipment I propose to use, but I see no reason why the plans I now have should not be carried through.

SPEAKER SYSTEMS

The program will be taken from the latest and best records I can find, and played on the best and biggest equipment.

I had hoped to obtain some original tapes as being perhaps the best source of sound, but it is doubtful whether those available would be better or more varied than the discs.

Because of the size of the hall, and our desire to arrange for the best sound distribution, I am planning to use four multi-speaker systems, two at each side of the stage. Each pair will be made up of a Goodman's three-speaker system of the type I have used before with a bass speaker and two pressure type middle and high units, and a five-speaker Wharfedale combination using a 15-inch woofer, two 8-inch middle speakers and two 3-inch tweeters.

These should be capable of handling any amount of power without distress, and, being rather different in their general design, should blend well.

Before the evening performance, we expect to spend some time experimenting with the placement of the speakers, in the hope that our findings will be valid when the hall is filled. It has a large balcony, and we will endeavour to cover this as well by suitably orientating the speakers, which we will be able to do because of their number.

All told, there will be sixteen separate speakers operating in the equipment and we should have an interesting hour or two getting them balanced and phased.

AMPLIFIERS

To drive this considerable array, we plan to use four 20-watt amplifiers, one for each speaker, a total of 80-watts available power. In case you are afraid of being blown through the rear doors, I would stress that they will be there to ensure the cleanest possible sound, and not necessarily to deafen you.

At the same time we might be persuaded to sneak up the gain controls once or twice, just to see what happens.

"Now, here's an unusual disc."

I really don't think one can have too much in reserve for such an occasion, for if we agree that a chance of 3 db is needed to realise an appreciable increase in sound, it means that we must double the power to do it.

And if one is already using, say, 20 watts, an extra 20 or more won't go very far if the fans still say they can't hear it!

These four amplifiers will be connected into a stereo control unit, of a type yet to be selected, and the whole will be driven from a high-grade moving coil pick-up.

One of the difficulties inherent in mounting such a demonstration is that the operators of the equipment, who will be behind the scenes, cannot themselves hear what is going on in the auditorium

And it is quite impossible to set level and balance controls with an empty house which will be valid during the performance.

MONITORING

To overcome this we will have probably two selected listeners provided with telephone handsets strategically placed in the auditorium, and they will be able to talk to the equipment operators and advise them on both points.

The temporary lines will, of course, be installed during the course of our preliminary tests.

The program will probably be divided into two parts.

The first will be an explanation and demonstration of the stereo effect in a manner I have not used before. We expect to use pure tones from an oscillator, and demonstrate the positioning of the sound when shared between the two speaker systems.

It should be possible to repeat the performance using a series of different frequencies to observe over what range the stereo effect is most valuable in that hall.

I may even be able to arrange to illustrate this part of the lecture with some slides dealing with microphone and loudspeaker coverage.

The remainder of the first half will be taken up with some effects records which have always been popular so that, by interval time, everyone should have heard the transfer of the stereo illusion from the field of instruments to the field of music.

SECOND HALF

The second half will be devoted to a musical program using the best possible recordings available at the time.

On display in the foyer of the hall will probably be some examples of audio equipment on behalf of some Sydney firms, and these will no doubt be interesting for you to see.

Everybody is welcome to come. Except for a few seats for members and special visitors, none will be reserved. The doors will open at 7.30 and those who arrive early will get the best positions.

n general, these will will be those rest a centre line from back to front, we hope to so arrange the speakers t, except for those right at the front at the extreme outside of the seat- area, all will be reasonably good.

After all, if you were listening to a ncert performance, the instruments rest you in those seats would also nd the loudest.

But we feel that everyone who comes ould at least get a seat, even if it 't an ideal one.

The balcony is largely an unknown, t there seems no reason why it should t prove extremely good, particularly there are no balcony seats close to stage.

There will be no charge for admit-nce, but we would like you to make donation to the Audio Society to help fray the cost of the hall, which is quite item in its way.

This is entirely up to you.

Printed programs will be available, to lp you follow what goes on.

Any further information can be ob-ned from Mr Roy Atkinson (FB2674) from the Audio Society, Box 3803, P.O., Sydney.

Until June 10, then, and looking for-rd to seeing you!

RECENT RECORDS IN REVIEW

WORLD FAMOUS TANGOS — Played by Malando and his Orchestra. Philips 840340BY (Stereo).

Let's assume that you like tangos, not unusual when they are played as well they are here.

Then we won't have to worry about ing technical over music on which I n't claim to be an authority.

I wouldn't query the statement on the ver, for instance, that Malando, al-ough a Dutchman, is famous in the d of the tango as a master with a ferent touch.

I can only say that they sound like gos to me, with tons of oomph and ythm, so apparently I like the touch .

Small combinations such as this lend emselves to separation, and, in fact, you were listening to them at close arters—and here the quarters are fair-close— you would hear plenty of it.

I wasn't surprised therefore to hear instruments grouped largely to either le, from which vantage point they in-lged in question and answer and gen-ally conversed in a highly interesting nner.

And to tie it all up, the accordion ayed at me straight down the middle.

Technically it is hard to fault.

The sound quality throughout is per-tly clear and clean, one of those discs hich serves to reassure me that the uipment is working well, that the re-onse curves are OK, and that the lus is still clean and sharp.

After a few hours of listening to a xed bag of discs, those similarly plac- will know how one appreciates a cord which serves to restore the status o.

There is very nice balance between everything—nothing intrudes, jars or jangles. The highs are free from any shrillness, the bass whops away satisfyingly, there is plenty of amplitude, and the surface noise is as low as the average good mono.

The miking is close, which give an immediate and vivid presence to the innumerable little solo bits.

In its accurate placement of instruments—guitar, accordion, piano and strings—I don't think it has ben excelled.

In other words, it's tops.

* * *

OFFENBACH — Selections from Gaite Parisienne. Played by the Radio Symphony Orchestra, Berlin, conducted by Paul Strauss DGG 133001 SLPE (Stereo).

Any lover of bright music could well consider this as a must for his stero collection. It has been on issue for a month or two now, and, in fact, I used it for my second stereo demonstration last year, and for some others as well

If general public reaction means anything, it should by now be well on the way to making its own popularity.

As it has been released for even longer in its mono form, it is another record which allows a direct comparison to gauge the effectiveness of stereo.

Once again the difference is the proverbial chalk and cheese.

This is a disc in which the "wall of sound" technique is very well displayed.

Most of the time it just isn't possible to identify the loudspeaker at all, although one is subconsciously aware of the various placements in space of instruments as they play.

With such boisterous and weighty music, this effect is as it should be, and it is completely appropriate that the full canvas should be used.

The sound is, if anything, a bit middly, in that there is no pronounced bass line working all the time.

It's obviously meant to be that way, for on the occasions when heavier bass does appear, and a drum is thwacked, the result is never in doubt.

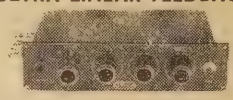
I won't comment on the music in detail, except to say that all the favorites are here, including a beautifully played Barcarolle.

Occasionally there is a slight suspicion of furriness in the reproduction, so slight that most pick-ups won't even notice it.

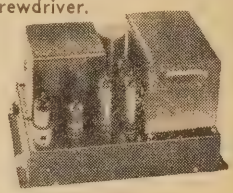
THE BUY OF THE YEAR!

The VERDIK QUALITY TEN

10 WATT PUSH-PULL ULTRA LINEAR FEEDBACK



Write now for full details of how you can instal Hi-Fidelity in your home with only a screwdriver.



AMPLIFIER and PRE-AMPLIFIER

Beautifully finished in Grey-Green Stove Enamel. Provision for tuner, bass and treble, 5-position selector for radio, mic., tape, LP and std. records. £52.10.0

Available at HI-FIDELITY SALES 158 Clarence Street, Sydney BX 5127

R290

STEREO!

Mail Orders promptly handled. C.O.D. if you wish. Free, complete, catalogue.

SPECIAL IMPORTS FROM Edels PTY LTD

Definitely Australia's widest selection of imported stereo discs

E.M.I. Stereophonic Demonstration Record — Sound Effects. Musical Excerpts

BEETHOVEN: Symphony No. 7. Philharmonia Orch.—Cantelli.

PROKOFIEV: Symphony No. 1—SHOSTAKOVITCH: Symphony No. 1. Philharmonia Orch.—E. Kurtz.

BEETHOVEN: Symphony No. 5, Overture Leonora—Berlin Philh. Orch—Cluytens.

BRAHMS: Piano Concerto No. 2 — Louis Kentner (Piano). Philharmonia Orch—Boult.

HOLST: The Planets—B.B.C. Symph Orch.—Sargent.

ROSSINI - RESPIGHI: La Boutique Fantasque—R.P.O—Goossens.

LEHAR: Highlights from "The Merry Widow."—Sadler's Wells.

COWARD: "Bitter Sweet"—Selections.

ST. LOUIS BLUES — Nat King Cole.

THE MILITARY BAND—Capitol Symph Orch.—Slatkin.

FRANK SINATRA SINGS FOR ONLY THE LONELY

GROFE: Grand Canyon and Mississippi Suites — Hollywood Bowl S.O.—Slatkin.

OFFENBACH: Gaite Parisienne — Hollywood Bowl S.O.—Slatkin.

BILLY MAY: "Billy May's Big Fat Brass."

Ask for Edels complete catalogue of Stereo imports.

STEREO NEEDLES!
STEREO CHANGERS!
STEREO CARTRIDGES!

Capitol RECORDS

EDELS PTY. LTD., 330 PITT ST.(In Griffs Furniture Store) MA6483

Dual

STEREO

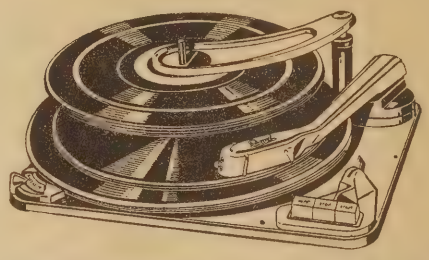
FA

New Release:

1004-S STEREO CHANGER

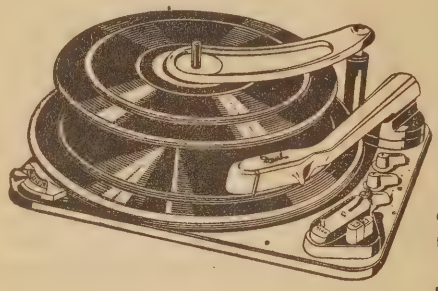
£37/9/6

In line with modern recording techniques we are proud to announce the release of the latest DUAL development Model 1004 S Stereo-Changer. All the necessary technical requirements have been incorporated for the efficient reproduction of Stereophonic Records. Three push buttons provide full control of all mechanical functions and the "Stereo-Key" permits the operator to switch from Stereo to Binaural reproduction of conventional records. Fitted with KS 2 Stereo head and twin sapphire assembly DN 3.



1004-T12S AUTO-PLAYER £31/18/-

1004T12 S Auto-Player is similar in appearance and mechanical operation to the already established model 1004T12. The Stereo version is complete for stereo fitted with KS2 Head, DN3 Needle Assembly and twin channel pick-up leads. This model is also suitable for playing monaural records.



1005 — CHANGER £37/9/6

Fully Automatic with many superb features to guarantee faithfull reproduction and reliability of operation. Automatic needle selection—built-in scratch filter—pause switch to control changing time cycle — roller glide selection of record size — Tonearm lock and many other carefully designed functions.
Fitted with the outstanding CDS3 cartridge and DN2 twin sapphire needle assembly.

1004–T12 AUTO-PLAYER £28/10

A new addition to the DUAL range, this model is the result of numerous demands for an automatic player retaining all the gentle operations and safety features of the changers without the actual dropping of records. All possibility of damage to records and styli is eliminated.

SPECIAL STYLI

DN24 (Diamond L.P. Sapphire Std.) £11/-/-
DN22 (Twin Micro Sapphires) £1/16/9
DN21 (Twin Std. Sapphires) £1/16/9
DN34 (Diamond Stereo—L.P. Sapphire Std.) £11/-/-

295 PLAYER £13/10/-

Fitted with automatic cut-off, this model is particularly suitable for building-in where space is limited or for use in portable units. Fitted with the CDS2B cartridge and DN2 Needle assembly, the same high quality of the larger DUAL models is retained.

AVAILABLE AT ALL LEADING RADIO AND ELECTRICAL STORES — LEAFLETS AVAILABLE ON REQUEST

Players and Changers are assembled, marketed and serviced by:

FRED A. FALK & CO PTY. LTD.

28 KING STREET ★ ROCKDALE ★ N.S.W. ★ AUSTRALIA

TELEGRAMS & CABLES: "GRAMOFALK, SYDNEY" ★ PHONE: LX 4783

Distributed by:
N.S.W. and VICTORIA—All leading Electrical Houses.
QUEENSLAND—Ron Jones Pty. Ltd., 1-5 Merton Road, South Brisbane.
S.A.—L. S. Wise Ltd., 196 Gilles Street, ADELAIDE.
W.A.—Athol M. Hill. 842 Hay Street. PERTH.

KLEMPERER'S CHORAL IS MOST IMPRESSIVE

BEETHOVEN — Symphony No. 9 in D minor (Choral); Incidental Music to Egmont, Opus 85. Played by the Philharmonia Orchestra with Hans Hotter, Aase Nordmo Lovebery, Christa Ludwig, Waldemar Kmentt and the Philharmonia Chorus conducted by Otto Klemperer. The soloist in Egmont is Birgit Nilsson. Columbia 33-OCX-L574-5.

I remember not long ago when reviewing an issue of the Ninth I played through five other versions in an attempt to assess the relative worth of the new one.

Today the list is far too long, and I would be reluctant to repeat the feat without substantial reward

Actually it isn't necessary, because this Klemperer performance isn't a difficult one to review.

It's just what one would expect of the conductor and the orchestra The main points of interest are in the success or otherwise of the recording.

There isn't any doubt about Klemperer's stature as a conductor, or of the performers' willingness to give their best for him.

His version is meticulous, extensively reasoned, strongly felt, and very long.

You have to be in a very philosophical mood to avoid moments when you wish he would condense his nobility and reverence for the music.

I have commented so often that only the very finest musical judgment can cope with Beethoven played slowly.

Klemperer no doubt realises this, and his judgment is good, but I fear he loses the value of contrast in his determination not to lose out on a single phrase.

Even the scherzo follows the same plan. A faster tempo would have illuminated a performance already weighted to the uttermost with time.

Now this is a matter of opinion, but it is the main cause of an impatience I feel when listening to some of his recordings.

Otherwise, I am willing and eager to applaud this as being in the front rank of Ninths.

I was particularly happy about the Choral movement. This is the best choir of any, and much care has been taken to subdue those dangerous sopranos by submerging them, too much for Beethoven, but just right for tape.

The singers are good, but the impossibility of assembling an ideal quartet which blends well, and is individually capable of its demanding task, seems now to be admitted by all.

Hotter is too immersed in Wotan, I fear, to catch the joyful declamation of the opening phrases of his announcement.

The fact that the singers can be criticised is a measure of the high standard achieved by all.

The quality sounds well, but is not free from errors of balance. One is the curiously disembodied bass which appears to have a spot of its own, not quite integrated with the rest of the orchestra.

Maybe it is the combined acoustics which result from mike placements which must catch so much besides the instrumentalists.

The soloists I thought were rather too forward for real life proportions, although their positioning isn't hard to accept.

And there is nothing wrong with the inner clarity of the orchestra.

Taken as a whole there is a magnificence about the performance which makes you want to turn up the volume, particularly in the last movement, and enjoy it to the full.

The Egmont excerpts are unusual, except for the overture, and not often heard. Here, again, the standard is extremely high, and the singer is a fine one.

The surface is particularly good—what a difference this makes.

Likewise the surface is good, but not completely free from fault—better than most.

One of the most enjoyable records I've yet heard in stereo

★ ★ ★

MASSENET — Selections from Manon sung by Renee Doria, Alain Vanso, and Adrien Legros with the Grand Symphony Orchestra conducted by Jesus Etcheverry. Philips PP P 77126 L.

The world of opera is filled with beautiful, unfortunate, and physically frail heroines, doomed to pay the penalty of a sad end, possibly because they were apparently beyond redemption and therefore could not prosper, or because a sad end gives a composer much more scope.

We can be thankful for the latter, otherwise much lovely and effective music would never have been written

Manon, of course, was one of these people, which is a shame, as no one who can sing so beautifully as Renee Doria should come to such an unhappy pass.

This record holds a generous selection of the most important arias and duets of Manon and her lover Des Grieux junior, with one from senior.

Just about everything is good about it.

The music is Massenet's best, and well deserves to be better known among record lovers. I sincerely hope this single disc will help to do it.

As one might expect from singers of the Paris Opera and Opera Comique, they are superbly masters of the roles.

Renee Doria's voice has an even quality which never varies, it has sweetness and flexibility and power. Vanzo sings clearly, fresh enough to sound youthfully ardent in a disciplined manner. One could not wish for better principals, or for those better matched in weight, ability or style.

Not only is the performance so good, but the recording is magnificently clear and poised. One rarely hears such beautiful articulation and balanced sound as, for instance, "Ah! Fuyez, douce image."

AT LAST!

HI-FI and STEREO at unbeatable prices for top-grade equipment. After years of catering for enthusiasts we are pleased to announce the opening of our wholesale and retail showrooms

To celebrate our opening, many bargains in imported and local equipment are available at INCREDIBLE prices.

Helpful advice is available without obligation.

ENCEL ELECTRONICS

354 and 361 BRIDGE ROAD, RICHMOND, VICTORIA, JB2820.

AWA RONETTE

MICROPHONES & ACCESSORIES

Type R572 £19/3/3 High impedance

Type R572/L £25/3/3 (low impedance, 200 ohms) duo cell omni-directional. Other types also available from

CHANDLERS PTY. LTD.

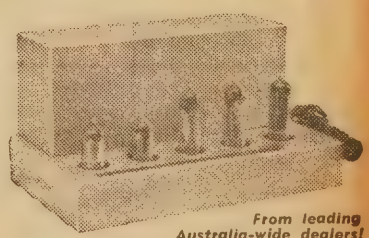
Albert and Charlotte Sts., BRISBANE, *(and leading wholesalers)*

AEGIS

AUSTRALIA'S OWN BRAND!

INDIVIDUAL

HI-FIDELITY UNITS



From leading Australia-wide dealers!

Aegis Basic 5/10 Amplifier	£40/5/-
Aegis Standard Control Unit	£7/17/6
Aegis Stereophonic Coupling Unit	£17/15/-
Aegis Pre-amplifier Mark 1	£21/17/6
Aegis Pre-Amplifier Mark 2	£26/15/6
Aegis Fidelity Radio Tuner Mark 1	£35/-/-
Aegis Fidelity Radio Tuner Mark 2	£32/17/6

(Capital city prices.

If unobtainable locally, contact:—

AEGIS MFG. CO. PTY. LTD.

208 LT. LONSDALE ST., MELBOURNE. FB373

A NEW MODEL *by*

Wharfedale: COAXIAL 12

WITH TWEETER VOLUME CONTROL

Based on an entirely new magnet design with two concentric gaps in the same plane, the WHARFEDALE COAXIAL 12 gives outstanding efficiency and performance at a much lower cost than has previously been possible.

The heavy main cone responds smoothly up to 4 kc/s, and has a low fundamental resonance giving superb bass when properly mounted.

Treble output above 4 kc/s is obtained from an entirely separate cone type tweeter assembly with its own magnet gap and aluminium voice coil. The response extends to beyond 20kc/s.

A constant impedance type volume control is connected to the tweeter by 3ft of flexible cable.

SPECIFICATION

MAIN CONE
Magnet gap diameter, 1¾in.
Flux density, 14,000 gauss..
Total flux, 155,000 maxwells
Foam surround.
Copper voice coil.
Fundamental resonance, 25-30 c/s.

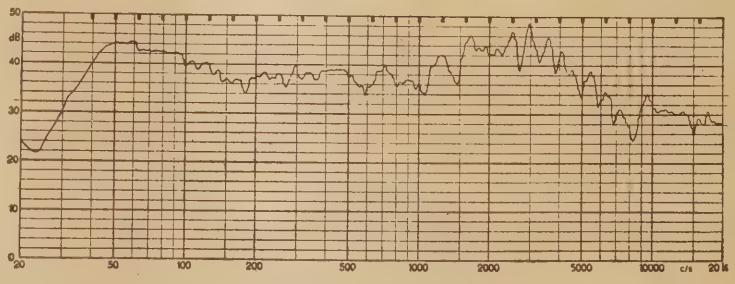
TWEETER ASSEMBLY
Magnet gap diameter, 1in
Flux density, 13,200 gauss.
Total flux, 44,000 maxwells
Foam surround
Aluminium voice coil and centre dome..

Accepted by the Council of Industrial Design for "Design Index."

Effective frequency range 25 - 20,000 c/s.
Impedence, 12-15 ohms only.
Weight (including volume control), 18½ lb.

Leaflet giving full data and details of suitable enclosures available free on request.

Axial frequency response of Coaxial 12 unit:



Ask our distributors for a demonstration and full technical data.

MELBOURNE:
Radio Parts Pty. Ltd., 562 Spencer St.
Homecrafts Pty. Ltd., 290 Lonsdale Street.
Warburton Franki (Melbourne) Ltd., 355 Londsdale Street.
J. H. McGrath and Co. Pty. Ltd., 208 Little Lonsdale Street.
William Willis and Co. Pty. Ltd., 428 Bourke Street.

BRISBANE:
Chandlers Pty. Ltd., cnr. Albert and Charlotte Streets.
Trackson Bros. Pty. Ltd., 157-159 Elizabeth Street.
A. E. Harrold Pty. Ltd., 123-125 Charlotte Street.
S. Martin and Co., Wilson House, Charlotte Street.

SYDNEY:
Audio Engineers Pty. Ltd. (N.S.W. Distributors to the trade), 422-424 Kent St
United Radio Distributors, 175 Phillip St.
Magnetic Sound Industries, 387 George Street.

ADELAIDE:
Gerard and Goodman Ltd, 192 Rundle Street.
Newton McLaren Ltd., 17 Leigh Street.
L. S. Wise Ltd., 196 Gilles Street.
Limbert Radio Co., 16 Charles Street.
Sound and Television Engineers, 233 Rundle Street.

PERTH:
Atkins (W.A.) Ltd., 894 Hay Street.
Leroya Industries Pty Ltd., 672 Hay St.
Electronic Industries Imports Ltd., 68 Railway Parade.

TASMANIA:
HOBART: Homecrafts (Tas.) Pty. Ltd., 220 Elizabeth Street.
Findlays (Hobart) Pty. Ltd., 80 Elizabeth St
Watson's Wireless, Collins Street.
M. T. C Gessup Pty Ltd. (incorporating Crosby Walch) Elizabeth Street
LAUNCESTON: Homecrafts (Tas.) Pty. Ltd., 120 Charles Street.
Don Phillips Radio, 87a Brisbane Street.
M. T. C. Gessup Pty. Ltd., 98 Charles St.

Australian National Distributors: ***Simon Gray Pty. Ltd.*** 28 Elizabeth St., Melbourne, C.1., tel's: MF 8166, 8211

And I include the orchestra in this, and in all my approving remarks. This is genuine hi-fi, and I hope some day it will be available in stereo.

It is idle to talk about the surface noise because there just isn't any.

In every way, the engineering is of the highest standard.

How can I avoid awarding a five star label to this lovely record?

★ ★ ★

BEETHOVEN—Symphony No. 7 in A, Opus 92; Symphony No. 8 in F, Opus 93. Played by the London Symphony Orchestra, conducted by Edouard van Remoortel. Vox APL 10970.

I now have to thank Vox for two of the most useful Beethoven records in my collection.

I say useful to mean records which combine good performance, low recording space, and special value for money.

The first is the previously released recording of the Ninth symphony on a single disc, which I notice others have reviewed even more enthusiastically than I did.

In its way, this new one is even better.

The recording is better, the playing is better, and the performance of an equal standard.

According to the jacket note, this is the first Vox disc made in England, and, if I may be so bold, it is better for it.

There are quite a few European orchestras recording today, but, outside about half-a-dozen famous names, they are of variable quality, even if their sincerity does not easily desert them.

But there is little doubt that the London orchestras and their handlers know the recording business, and their general standard has been unsurpassed for some years.

FINE PERFORMANCES

These performances are good enough to bear the name of any orchestra in the catalogue.

I think there have been some of the usual compromises to long playing. These are not very noticeable in the dynamic range, which is quite good, but the bass amplitude is a bit light. It is very hard and clean—witness the tympani—but it hasn't very much depth, there isn't much use boosting it.

It isn't missed so much because the Seventh, at any rate, is a rather remote concert hall recording.

It's a little more prominent in the Eighth, but on the whole the sound quality of each is of the same order, bright and clean, and free from groove echo.

Both performances are taut, vigorous and entirely reliable. The conductor hasn't tried to "do anything" with the music, nor does he feel imperative to put a signature to it in the way of conceit or style.

I can't think of anything I actively disliked, which means that it will wear well and can be safely recommended.

The playing is really excellent. The orchestra sounds right on its toes, its unanimity and vitality are fine and one could not ask for better discipline.

Some of the movements in both symphonies can hold their own with any as examples of good Beethoven.

The longer the record ran, the better I liked it.

The surface is good and the cutting amplitude quite high.

Memo to vox—more please!

★ ★ ★

LISZT—Piano Concerto No. 1 in E flat; Piano Concerto No. 2 in A. Played by Alfred Brendel and the Pro Musica Orchestra of Vienna. Conducted by Michael Gielen. Vox APL-10420 (Stereo).

When this record was first released in its mono version, I gave it very high praise on all counts.

It is brilliant, virtuoso Liszt of the first quality, full of imagination and powerfully stated on the part of the pianist who has almost unlimited technical resources.

But despite his brilliance, he is not merely a hammerer, nor does he display his ability merely to dazzle, or make it an excuse for the wearing and sometimes incomprehensible gabble produced by some others similarly endowed but with much less discretion and taste.

It was most interesting to play the mono version at the same time as the stereo.

The gain in breadth and realism was most remarkable. I do not remember whether I suggested that this disc has been recorded with stereo in mind, but hearing it in this form is enough to convince me.

The piano mixes well with the orchestra, but it has a most impressive presence. Some of its heavier bass notes will test your equipment and pick-up tracking, although I have played it successfully in public and private on both moving coil and crystal types.

There is a good deal of reverberation on both sides which adds magnitude to the atmosphere.

The sound spreads rather than separates as it should, and there are few opportunities for the subtlety heard in some of the discs recently reviewed.

But on the whole it is mighty fine Liszt and would be hard to better at the moment.

Mostly the sound is good, but it does deteriorate a bit near the end of the sides and a few odd places on the way seemed to have a few whiskers on them. But only top quality gear is likely to seek them out, and my copy was a pre-release job.

The surface has a few crackles as, alas, have even the best stereo discs so far, but comparatively it's not at all bad.

This is one you should hear.

★ ★ ★

GLINKA—Jota Aragonesa, Kamarinskaya, Valse Fantasie, Russlan and Ludmilla Overture, A Life for the Tsar Overture. Played by the Bamberg Symphony Orchestra conducted by Jonel Perlea. Vox ST-APL 10600T (Stereo).

An interesting disc if not an outstanding one. The interest begins with the music. Glinka is overshadowed by the mightier figures in Russian music who followed him and only a few items of his are now played, some of which are found here.

In quality it is somewhat patchy. The sound in general is not very vivid, and not in competition with the superlative stuff we are beginning to receive. But when one gets adjusted, its shortcomings get by.

The orchestra has a small sound and

NEW SUB KITS

FOR R. & H. TYPE

DESIGN TEST EQUIPMENT

Sweep and Marker Generator. Case, chassis completely punched dichromate plate ready for assembly and black enamellised calibrated and punched front panel, £5/12/-, plus 12½% tax, plus freight.

Wide Band Scope. Case, all the completely punched chassis, dichromate plated fittings with black enamellised and punched front panel. £10/19/6, plus tax, 12½%, plus freight.

Senior V.T.V.M. Case, chassis, completely punched and dichromate plated ready for assembly and black enamellised calibrated and punched front panel. £4/8/6, plus 12½% plus freight.

Bench Type V.T.V.M. Case, chassis punched and dichromate plated and black enamellised calibrated front panel. £2/9/6, plus tax 12½%, plus freight.

Audio Signal Generator. Case, chassis completely punched and dichromate plated ready for assembly with black enamellised calibrated front panel, £4/8/-, plus tax, plus freight.

R.C. Bridge. Case, chassis punched and dichromate plated and black enamellised calibrated front panel £3/4/6, plus tax, plus freight.

All the above with engraved front panel, £1/14/- extra.

Engraved front panel calibrated for any of the above types 50/-, plus 12½%, plus post 1/4. Black enamellised and calibrated front panels for any of above. 19/6, 12½% tax, plus postage 1/4.

Instrument Cases, R. and H. Type, finished in grey hammer baked enamel.

MC5A, 9 x 6.7/8 x 5½, 21/-, plus 12½% tax, plus postage.

MC82A, 13 x 8 x 6.7/8, 38/6, plus 12½% tax, plus postage.

SF7A, Sloping Front, 7½ x 7½ x 7¼, 21/-, plus 12½%, plus tax, plus postage.

Standard Instrument Cases. Finish Grey.

Cat. No.	Long	High	Deep	Price plus 12½% S.T.
MC6	6	6	6	13 0
MC7	10	8	7	1 1 0
MC67	12	7	6	1 2 6
MC81	10	10	8	1 7 6
MC811	12	11	8	1 10 0
MC79	15	9	7	1 15 0
SLOPING FRONT CASES				
SF7	7¼	6½	6	1 1 0
SF79	9¼	6½	7¼	1 15 0
SF71	11	6½	7¼	1 10 0
SF8	13	8	8½	1 11 6
SF10	18	10	10	2 6 0
SF79A	9¼	7¼	7¼	1 5 0
SF71A	11	7¼	7¼	1 10 0
SF8A	13	8¾	8¾	1 11 6
SF10A	18	10	10	2 6 0

Chassis unpunched can be supplied for any of above.

Mackinnon and Nicholls Ltd., 468 Collins St., Melbourne.

Martin de Launay Ltd., Newcastle.

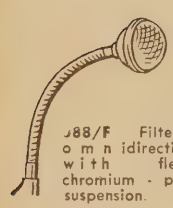
Prices slightly higher Interstate.

R. H. Oxford & Sons Pty. Ltd.

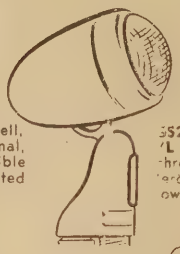
97 Marriott St., Redfern, N.S.W. MX3764

A MICROPHONE FOR EVERY PURPOSE

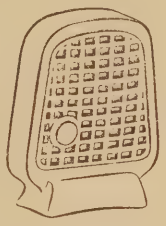
AWA carries a complete range of Ronette Crystal and Reslo microphones and accessories for your every need!



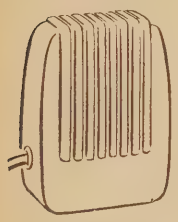
88/F Filtercell, omnidirectional, with flexible chromium - plated suspension.



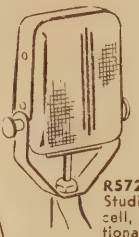
GS210 & GS210-/L Streamlined chrome finish, filtercell, high or low impedance



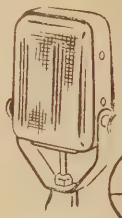
C53 Hand or stand, omnidirectional, black plastic housing and hand-grip.



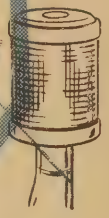
HM7 Hand or stand microphone, filtercell robust die-cast housing, attractive finish



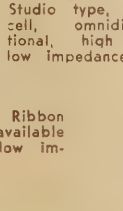
44 Hand or desk mounting, counter-balanced base, ivory plastic housing.



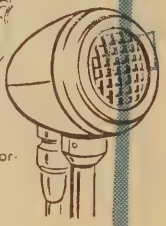
S474 Studio type, cell, omnidirectional

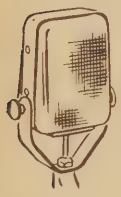


S472 Duo cell omnidirectional suitable for cable suspension



R572 & R572/L Studio type, duo cell, omnidirectional, high or low impedance.





RFC5 & RFC5/L Filtercell, semi-directional, high or low impedance

RBH/T Ribbon velocity, available high or low impedance.

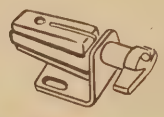
B110 Plastic torpedo form.

DPH Dynamic with metal diaphragm High or low impedance.

AWA RONETTE PICKUPS & CARTRIDGES

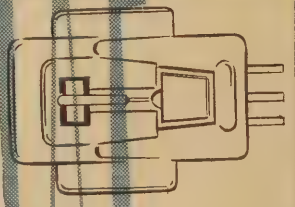
Wide range p/u turnover heads type FF2 and FF3. Type FF22 stereo.

TX-88 wide range.



Turnover p/u cartridge TO-284/OV; TO-284/P; TO-284/T; TO-284/TX; TO-284/PX

Stereo TO-OV



FF40—wide range stereo cartridge

PUBLIC ADDRESS MICROPHONES

Marketed and guaranteed by

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

● 554 PARRAMATTA ROAD, ASHFIELD. UA0791. ● 167 QUEEN STREET, MELBOURNE. MU9161.

Available in other states from:—
NEWTON McLAREN LTD., ADELAIDE ● NICHOLSON'S LTD., PERTH ● CHANDLERS PTY. LTD., BRISBANE. and from leading wholesalers.

the acoustics haven't done much to lessen this effect.

In fact the pre-occupation with the woodwind rather heightens it, although these instruments are very useful in defining stereo positioning which may have been in mind at the time.

But the Bamberg Orchestra seems to have been always interested in this section.

The stereo spreads quite well—one can easily pick the difference over mono playing—and instrumental separation is used with discretion. There are no gimmicks here

The performances are not particularly lively, and surely there is a slip up on the label. If the Summer Night in Madrid is on the disc I couldn't find it, although it is also mentioned on one place on the cover.

On the surface of my disc there was a fair amount of noise but it might have been characteristic of one copy. It was enough to intrude on many passages at anything more than moderate volume. One or two spots mightn't sound quite clean on wide range equipment.

★ ★ ★

HAYDN—Symphony No. 92 in G major (Oxford); Symphony No. 104 in D minor (London). Played by the Sinfonia of London, conducted by Alexander Faris. World Record S11.

Performances are sound but uneventful.

The tempos of the music are rather brusque and there is too much straight up and down playing for the full grace to come out.

The third movement of the London is an example.

It is unified and disciplined but it has little delicacy or glow.

The result is safe, matter of fact and workmanlike.

The orchestra plays very well. Sonically it is remotely recorded, the top end is well defined but the bass can stand strengthening with benefit.

The string tone as a result is harder than it really is.

I often think that many who listen to records forget how sharp violins really sound when heard in a small recording chamber.

This one appears small, and lack of reverberation has produced a deadness not unlike some of Toscanini's early studio H recordings.

However, it is a reliable performance of two of Haydn's best symphonies, and the fact that they are on a single low-priced disc weighs heavily in their favour.

★ ★ ★

BEETHOVEN — Sonata in C Sharp minor Opus 27 No. 2 (Moonlight); Sonata in C minor Opus 13 (Pathetique); Sonata in F minor Opus 37 (Appasionata). Played by Joseph Cooper. World Record TT16.

Joseph Cooper is apparently a pianist who believes in making the music live up to its name.

He sketches the music broadly, is not over-meticulous about the precise weighting of the phrases, nor does he resist the temptation to rush his fences where his purpose is served.

His technique is adequate but somewhat slapdash.

Nevertheless he has good opportunities to exhibit his legato, which he does very well.

Less attractive is the clanginess of his right hand which the recording hasn't made any better. The piano is otherwise satisfactory, although the cutting amplitude is only average.

The surface noise won't be noticed at normal volumes, and mostly a slight hiss only if you turn it up.

Biggest feature is the capture of three sonatas on one disc, and the favourites at that. A valuable asset, even in the absence of a Solomon or a Backhaus.

★ ★ ★

MAX BRUCH—Scottish Fantasy, Opus 46; WIENIAWSKI—Concerto No. 1 in F sharp minor for Violin and Orchestra, Opus 14. Played by Michael Rabin and the Philharmonia Orchestra conducted by Sir Adrian Boult. Columbia 33CX 1538.

The Tallis music is one of the composer's most familiar works and one of his best. Vaughan Williams has a greater claim to fame in these shorter compositions than is often realised.

When judged by the standard of successful accomplishment of a given objective I think his briefer moments are even more successful than his symphonies.

It is a great pity that the task of assembling suitable soloists prevents more performances of his Serenade to Music—a small masterpiece if ever there was one.

The Tallis variations are quite well played and smoothly recorded.

In this lies my main point of criticism, if a minor one. It is illustrated most clearly in the viola passages which we are accustomed to hear more clearly cut and quite differently phrased.

The total effect here is organ-like, and although this is not out of place there is something about the playing which is not altogether English in style, although it is difficult to be more specific.

Recording is round and full. All the strings are clearly identified and blend into a satisfactory body of sound. The

AWA RONETTE

MICROPHONES & ACCESSORIES

Type RFC5
£15/10/8
High impedance)
Type RFC5L
£21/12/-
(Low impedance 200 ohms).
Technical pamphlets will be mailed on request.
Other types also available from

NICHOLSONS LTD.
BARRACK ST., PERTH.
(and leading wholesalers)

ESSENTIAL

for Stereo Systems — STEREO LEVEL INDICATORS

Consisting of two identical meter movements reading on one scale perfect for checking balance, frequency response, output level etc
Frequency response: 20—20,000 CPS plus or minus 1DB.

Sensitivity: Full scale deflection adjustable 1.9 — 23V
Calibrated in DB and percentage
Model ST-A Portable
Model ST-B Panel Mounting £8/7/6
Also available in single channel model, identical characteristics.
Model AU-A Portable.
Model AU-B Panel Mounting £4/17/6

SENSATION

The Tandberg 5—four track stereo tape recorder. Gives over 8 hours stereo recording or 16 hours monophonic on 7in reel of tape. Total weight 28lb. This is an outstanding recorder of truly professional performance. Both replay amplifiers are inbuilt with separate level controls, and allow for monitoring or monaural recordings. Price complete with microphone and carrying case, £266.

STEREO AMPLIFIERS AND PREAMPLIFIERS

Astronic. "One Two Eight" — for crystal pickups — both amplifiers and control unit in neat, self contained case. £59/18/

Astronic Stereo Preamplifier. Accommodates all pickups with presence and rumble filters, £48/1/.

Grampian 590/2. Twin 7½ watt amplifier, with stereo control unit in cabinet, £91.

Grampian 590/1. As above but with only one amplifier for use in mono unit for stereo extension later. £58/5/.

Grampian 584 Amplifier. Converts model 590/1 to model 590/2 £27/19/-.

We have available a comprehensive range of stereo pickups, cartridges, motors, and complete players ranging from £16/16/ to £150. Why not call and discuss your requirements

CALL, WRITE OR PHONE

AE Audio Engineers PTY. LTD.

422-4 KENT STREET, SYDNEY.

PHONE BX6731

Model 8MX, the latest addition to the Rola family of extended range loudspeakers, has been developed specially for use in stereophonic systems. This 8 inch loudspeaker requires only a 1.9 cubic foot capacity vented enclosure for peak performance, a feature which makes it ideal for two-speaker stereo units in the average-sized living room in which the large enclosures needed for the 12MX, 12-OX and 12UX take up too much space. Hear the Rola 8MX — its tonal quality will astound you!

ROLA MODEL 8MX STEREO LOUDSPEAKER SPECIFICATIONS:

Power handling capacity	7 watts peak
Diaphragm	
Fundamental resonance	65 c.p.s.
Frequency response	60 c.p.s. — 10 k.c.
Voice coil impedance	15 ohms at 400 c.p.s.
Air gap flux density	9,350 gausses
Total gap flux	36,800 lines
Principal dimensions:	
Overall diameter of diaphragm housing	8 1/16"
Diameter of baffle opening	7"
Diameter of voice coil	1"
Depth of pad ring to rear	3½"
Finish:	
Baked enamel diaphragm housing, magnet shell black lacquered	
Transformer	Type C
Weight	1 lb 7¼ ozs. without transformer

ROLA COMPANY (AUST.) PTY. LTD.

accompanying tape noise is noticeable at the start but is generally well below the average level. The final diminuendo is nicely judged but, I suspect, has some assistance from a judiciously turned knob.

The Schoenberg is not nearly as well known as the Tallis and is quite unlike the composer's later works in which his exploitation of such things as the 12-tone scale many find hard to accept.

It is, in fact, a tone poem in the manner of Richard Strauss and is influenced musically by both Strauss and Wagner. It is difficult to understand why its original form was as a string sextette, as the contents and scope are manifestly far beyond the capacity of such limited forces.

The composer's appreciation of this lies in the fact that he finally rescored it for orchestra and revised his scoring in 1935, which I expect is the version used here.

I thought this side the best and certainly the most interesting. A good deal has been written about its technical success and it is fairly obvious that the composer himself had several minds in the matter. It hasn't anything like the clarity of the Strauss with which it is compared, but it has considerably greater intellectual stature.

One can well hear in it a composer who has not nearly reached his full development, or even found his ultimate goal, whereas with Strauss we can only hope for further examples of substantially the same musical processes.

Technically it is typical Coronet quality and has a very good surface.

★ ★ ★

BEETHOVEN—Concerto No. 5 in E flat major (Emperor), Opus 73. Played by Eugene Istomin and the Philadelphia Orchestra conducted by Eugene Ormandy. Coronet KLC 2686.

Although I did not think this an ideal Emperor it was much better than I expected. Neither Istomin nor the Philadelphia Orchestra would have been my choice for a first-rate performance, but the fact remains that both have tried hard, and in many ways successfully.

But you will have to be in favour of a fast-moving, vigorously handled view of the music to pick it as the best of the bunch.

In my opinion really good Emperors are few and far between; ever since Schnabel and Backhaus showed how it should be played. Most of their successors, in both studio and concert hall, have not equalled their performances.

This was the first Beethoven concerto with which I became closely familiar years ago, when circumstances obliged me to pore over every note.

And being incurably addicted to the classical approach I found this one too unsubtle, capricious and even noisy to place among the great performances.

Istomin attacks the first movement with considerable vigour and clean technique but with no real sense of the heroic.

In the slow movement his mental state doesn't really change at all, as it assuredly must do if Beethoven's intentions are to be observed.

And why he plays that succession of staccato chords as though they were some extension of a scale practice passage I just do not know.

These are tricks which I grieve to hear so often today. No one expects all pianists to play exactly in the same way—they could not do so if they tried — but there are essential elements in style which should not be forgotten, and cannot be if the exponent is to enter the front rank.

In general the dynamics are too often severe and unreasoned.

Apart from these matters the technical standard of the disc is good. The piano registers with excellent balance for the most part, although there are times when I felt its apparent location had been altered by the man on the balance controls.

But sonically it more than compares with any version on the market, and that's a big advantage.

As a performance it doesn't achieve that air of dedication we expect with Beethoven.

The surface is quiet and the record should play well on anything.

★ ★ ★

SCHOENBERG — Transfigured Night, Opus 4; VAUGHAN WILLIAMS—Fantasia on a Theme by Tallis. Played by the Strings of the New York Philharmonic conducted by Dimitri Mitropoulos. Coronet KLC 2681.

The Scottish Rhapsody proves to be a melodious and beguiling work which is musical firstly and anything else well afterwards.

It has naturally nothing of the famous violin concerto about it apart from a passage near the beginning—almost as though the composer had deliberately placed his signature upon it before commencing his main intentions.

The material is made up from Scottish melodies, presumably authentic—at any rate they sound like it. They are treated with the musical competence and melodic imagination characteristic of Bruch and are very easy to listen to.

There are some pretty and refreshing problems for the soloist which Michael Rabin in the main finds no problem at all.

He has a nice G-string tone and his microphone aspect suits it very well.

His upper registers are generally on the thin side and their sound is not always attractive. But I should consider it a faithful picture of what went on.

What is good is his light and lively touch which makes the music sparkle and dance.

The same quality of performance is heard in the Wieniawski, a better-known work of the same general weight and standing as the Bruch.

And once again it is pleasant, flowing stuff in which the execution is of equal importance to the material, much of which is taken up with stylish runs and repetitions that flow along like a warm stream and with the same tendency to send you to sleep if you allow them to envelop you.

The orchestra hasn't a strong part in either work, for the violin is always the leader.

But the Philharmonic is too experienced not to do its part with distinction, and quite frequently its fine relaxed tones seep through the fiddle's forward performance.

Technically it is not a heavy performance but it is clean and clear with a good surface.

GRUNDIG

GRID

DIP

OSCILLATORS

- FREQUENCY RANGE
  1.7—3.7 Mc/s
  3.7—8.0 Mc/s
  8.0—17.0 Mc/s
  17.0—40.0 Mc/s
  40.0—100 Mc/s
  100—250 Mc/s
- ACCURACY + 1.5%
- AC MAINS OPERATED 110-240V 40-60 CPS
- CONSUMPTION 10VA
- OPERATIVE CONDITIONS

'E' Receiver
'G' Grid Dipper
'W' Absorption Wavemeter
'S' Modulated Oscillator

£33/15/-
INC. S. TAX

The House of Quality Products

WILLIAM WILLIS
& CO. PTY. LTD.
428 Bourke Street,
Melbourne C1
Phone MU2426

SHORT-WAVE NOTES BY ART CUSHEN

ARMED FORCES STATIONS INCREASE SCHEDULE

A marked increase in the broadcasting hours of both the Los Angeles and New York stations of the Armed Forces Radio Service have been announced.

WITH the introduction of the summer schedule the Los Angeles station increased its broadcasting hours to 17 each day and now operates from 8.00 a.m. through to 1.00 a.m. The two main time blocks are devoted to baseball from 1.00 and 7.15 p.m. and all the balance of the program is of news features and musical transcriptions.

AFRS station in Los Angeles, which identifies as the Armed Forces Radio and Television Service, has the mailing address of 1016 North McCadden Place, Los Angeles 38, and has a service area to Alaska, Philippines, Japan, Korea, and the Caribbean. The programs of the station are used as a major part of the transmissions of the smaller Armed Forces stations dotted throughout the Pacific.

The Los Angeles station now is using the following schedule, KCBRI (21740) noon-4.00 p.m., KCBR2 (21460) 8.00 a.m.-4.30 p.m., KCBR3 (17815), 8.00 a.m.-4.30 p.m., KCBR5 (9570) 4.00 p.m.-10.00 p.m., KCBR5 (15315) 10.15 p.m.-1.00 a.m., KCBR2 (9700) 5.00 p.m.-1.00 a.m., KCBR3 (11715) 5.00 p.m.-1.00 a.m., KCBR4 (15315) 4.00-6.00 p.m.

The broadcasts from New York, which have the target areas as Europe, North America, Greenland and Caribbean, are carried from 12.30 to 8.45 a.m. on WBOU5 (17760), WDSI1 (21650) to Europe, Munich (15385) to Middle East. From 3.30 to 8.45 a.m. the broadcast is on WBOU6 (15270), WRUL2 (15380) to North Africa and Greenland, WRUL3 (17710) to the Caribbean.

XEWW on 15160 Kc.

THE instability of the Mexican stations has long been a feature of broadcasts from this country, and in January we reported hearing the XEWW transmitter on 6167 Kc. in the 49 metre band. It now appears this station has reverted to the old frequency of 15160 Kc., and has been heard on this channel in the United States.

The program which is the same as on 9500 Kc. is from the broadcast band station XEW. The latest report shows that the station has extended its schedule and now closes at 4.45 p.m. instead of 4 p.m. as in the past. Broadcasts from this Mexican station are the best received in this country, and the 9500 Kc. signal can be tuned in most afternoons.

Broadcasts from Berne

BROADCASTS in English from the Swiss Broadcasting Corporation in Berne are now on a winter schedule, and will be received according to the following transmissions schedule. To Eastern Australia and New Zealand, 5.15 to 7.00 p.m. on 21520, 15305 and 11865 Kc.

Western Australia and the Far East, 7.00 to 7.45 p.m. on 21520, 15305 and 11865 Kc.

South East Asia and Japan, 10.45 p.m. to 12.30 a.m. on 21520, 17774, 15305 Kc.

India and Pakistan, 12.45 to 2.30 a.m. on 15305 and 11865 Kc.

To South Africa 12.45 to 2.30 a.m. on 21520 Kc.

Middle East at 2.45 to 4.30 a.m. on 15305 and 11865 Kc.

North America from 11.30 a.m. to 1.15 p.m on 11865, 9535 and 6165 Kc.

To North America, 2.15 to 3.00 p.m. on 15305, 11865 and 9535 Kc.

Federal Broadcasting Service of Rhodesia last month inaugurated a commercial program which is carried on transmitters in both Salisbury and Lusaka. The broadcasts are on Salisbury 6018 Kc 10 Kw., 2.00 to 8.00 p.m., 9505 Kc, 300w, 3.45 p.m. to 8.00 p.m., 3395 Kc 20 Kw., 6.00 to 7.00 a.m. The transmissions from Lusaka are on 4911 Kc, 10 Kw, 2.00 to 3.00 p.m. and 6.00 to 7.00 a.m., 7220 Kc 10 Kw., 3.00 to 5.00 p.m., 11722 Kc. 10 Kw. 3.00 to 8.00 p.m.

International Radio Conference

THE forthcoming conference at Geneva next month promises to be of special interest to shortwave listeners, as the subject of the jamming of radio transmissions is to be discussed. The conference will also revise many frequency bands, and in this view the short wave listener, and the DX organisations of the world, will be represented for the first time. Mr O. Lund Johansen well-known as the Editor of "World Radio Handbook" will be present and will along with many representatives from the amateur radio fraternity keep watch on their own aspects of the radio hobby.

This is the first time the short wave listener has had official representation and we are sure Mr Lund Johansen is the best-known, and as far as the broadcasting organisations are concerned, the person who can do most good for them and us, in this continuous conflict of jamming and taking over of unauthorised frequencies.

Omdurman using 20 Kc.

THE transmissions of Radio Omdurman in Khartoum, Sudan, now use the high power of 20,000 watts on some frequencies, according to a verification letter we have received from the station. The station has programs devoted almost entirely to Arabic listeners, but an English program is on the air each day from 2.00 to 2.30 a.m.

Listeners will find that reception of the station is possible both in late afternoons and also again in the mornings. The station is at present operating on the schedule of 2.15 to 3.30 p.m., except Friday when the transmission is extended to 7.30 p.m., 12.30 a.m. to 6.00 a.m., and on Fridays this broadcast is extended to 6.30 a.m. The station uses 5039 Kc. 20 Kw., 9600 Kc. 7500 W., 11855 Kc, 20 Kw.

Sierra Leone on 3316 Kc.

THE reception of a new country is always of unusual interest and during the past few weeks the signals of the Sierre Leone Broadcasting Service at Freetown have been such that reception at fair level is possible.

The station uses the frequency of 3316 Kc and listeners will find the station opens at 4.45 p.m. with five minutes of news of a local nature in English, while a further 10 minutes in a local vernacular is broadcast. At 5 p.m. a relay is carried of the B.B.C. news from London. The station which has the power of 5000 watts, also carries B.B.C. news at 4 a.m. The complete schedule of the station is 4.45 to 6.00 p.m., 2.45 to 8.00 a.m. The news sessions are of a local nature at 4.45 p.m. and 6.10 a.m. following the B.B.C. news at 6 am. The station also carries many programs of African music, and the station address is New England, Freetown, Sierre Leone.

NOTES from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, N.Z. All times are Eastern Australian.

Radio Rural on 15105 Kc.

THE operation of the new Rio de Janeiro station Radio Rural was reported in these pages some months ago, when the station was testing, but we have now heard this transmitter during its normal daily operations. The station has been received at surprisingly good level from shortly after 7.00 a.m. to 7.40 a.m., at which time the signal receives severe interference from Lisbon which opens at 7.45 a.m. on 15100 Kc.

Radio Rural operates on 15105 Kc and this frequency is used at 8.00 a.m. by the Montreal station CKUS with its service to Latin America, and from this point the Brazilian signal cannot be heard.

The station identifies at 7.30 a.m. as "Radio Rural, Rio de Janeiro, Brazil" and the program is popular Portuguese musical numbers. The station's address is the Ministry of Agricultura, Rio de Janeiro, and its 10Kw transmissions are used for broadcasts of a rural nature to the farming communities in central Brazil.

Broadcasts from Djakarta

THE broadcasts from Radio Republic Indonesia, are well received in this area, and the foreign service, which has undergone many frequency changes is listed below.

Indonesian to North America and South East Asia, 11.00 a.m. to noon on 11785 (YDF2) and on 9585 (YDF6).

Indonesian to Europe and Middle East, 4.00 to 5.00 a.m. on 11785 (YDF2) and 9865 (YDF8).

English to Australia and New Zealand from 9.00 p.m. to 10.00 p.m. on 9585 (YDF6), 11785 (YDB2).

English to South East Asia from 12.30 to 1.30 a.m. on 9585 (YDF6) and 11785 (YDB2).

English to Europe and New Zealand 5.00 to 6.00 a.m. on 11785 (YDB2) and 9865 (YDF8).

Chinese broadcasts to South East Asia and China from 10.00 to 11.00 p.m. on 11785 (YDF6) and 9585 (YDF6).

Other transmissions include Arabic 11.00 p.m. to midnight on 11785 and 9585 K: Urdu from 12.00 to 12.30 a.m. also on 9585 and 11785 Kc: Hindi from 1.30 to 2.00 a.m. also on same frequencies, while in French from 1.30 to 2.30 a.m. on 7270 and 3277 Kc. A further program is on 3.00 to 4.00 a.m. using 11785 and 9865 Kc. Power of the YDF transmitter is either 50 or 100 Kw and that of YDB 1Kw, except for one transmission when the 100 Kw transmitter is used with this call sign.

FLASHES FROM EVERYWHERE

CONGO REPUBLIC, the former French Equatorial Africa is the site of the 4Kw. "Radio AEF" transmitter, uses 7295 Kc, and is now on a new schedule of broadcasting hours. The station is transmitting 3.30 to 4.30 p.m., 9.00 to 10.00 p.m. and 2.30 to 7.00 a.m. On Monday the station signs off at 6.45 a.m. The station for the evening transmission also uses 9555 Kc, and from 2.30 a.m. carries the transmissions on 4795 Kc

SUDAN Republic with broadcasts from Bamako is broadcasting 4.30 to 5.30 p.m., 10.30 to 11.00 p.m. and 4.30 to 8.15 a.m., while on Sunday the transmission is extended to 9.00 a.m. The station is using 4835 Kc to the end of our evening reception, and again in the mornings, and from 7.00 p.m. uses 9745 Kc also with 4Kw.

THAILAND which for some months has been heard with its transmissions on 1500 Kc has made an appearance on short wave. The station uses 5270 Kc, though this is announced as 5300 Kc, and leaves the air at 2.30 a.m. The station signs off in English and much of the program heard is of a commercial nature, with many items of English recordings. The station has news in Thai at 2.00 a.m. and its full schedule appears to be 9.00 a.m. to 2.30 a.m.

ZANZIBAR station has plans of increased transmitter power, and this station's latest schedule includes the use of further new frequencies. The Zanzibar Broadcasting Service, is on 8.25 to 9.30 p.m. and 11.30 p.m. to 2.30 a.m. using 6005 Kc with 3500 watts. In the future 4795 Kc is scheduled to replace 6005 Kc with increased power.

BELGIAN CONGO Radio Bukavu which has the mailing address of Post Office Box 1100, Bukavu, Costermansville, is on 4808 and 7212 Kc using the power of 10 Kw. The station is on the air 1.30 to 4.00 a.m. and has news at 2.00 and 2.30 a.m.

FRENCH CAMEROONS which has a 4000 watt transmitter for Radio Cameroon 1 is using 9657 Kc from 9.00 p.m. to 2.30 a.m. and then the balance of the transmission is on the regular frequency of 4975 Kc. The Cameroon 3 transmission is radiated from Garoua, and uses 7240 Kc, with 4000 watts. The station signs off at 6.00 a.m. except Friday, Sunday and Monday when the station leaves the air at 7.00 a.m.

HAVANA station COCY which has been inactive for many months is again reported from the United States as being heard on its normal frequency of 11750 Kc. The station has been heard from 9.00 a.m. to 3.00 p.m. and relays the broadcast band station CMW "Radio Rebelde," "Radio Oriental" Santiago has moved to 6310 Kc, and "Union Radio." Havana has shifted frequency to 6300 Kc.

HAITI adds another shortwave broadcaster to its growing radio stations with Radio Lumiere, P.O. Box 71, Aux Cayen, using 3455 Kc. from 8.30 to 10.00 p.m., and from 8.00 a.m. to 12.30 p.m. The station should be possible when opening at 8.30 p.m. on a suitable night and appreciates reception reports, which are verified by letter.

PERU station "Radio Loreto," Iquitos, which was heard in this area so well last winter has moved frequency from 9595 to 9504 Kc, and uses the callsign OAX8E. English is now on the air each Tuesday and Friday at 4.30 p.m. with the target area as the Amazon area, according to verification received from the station.

KOREA with broadcasts from Seoul is now using the new frequency of HLK9 on 17745 Kc, and this one is used with 15415 Kc HLK8 from 3.30 to 4.30 p.m. beamed to West Coast of U.S.A. A further broadcast from Seoul, on 15255 Kc, from 5.30 to 6.30 p.m. to Hawaii.

FRENCH CAMEROONS station which was on 7240 Kc with 4Kw, has moved to a frequency of 5010 Kc, for the transmissions which we are hearing in the mornings. A Cyprus report gives the schedule on this frequency Tuesday, Wednesday, Thursday and Saturday 4.00 to 6.00 a.m., and on the other days from 3.00 to 7.00 a.m.

MOROCCO station at Rabat, which for many years has used the French relays on a frequency of 7214 Kc has altered this to 7336 Kc. The station broadcasts from Rabat from 4.00 to 7.00 a.m. daily.

BANGKOK which in the past few months has been very active with its continuation of new stations on the air, many of these being privately owned, has been heard in Cyprus on 4995 Kc. The station has been heard to sign off at 1.25 a.m. with the National Anthem.

BRUSSELS has introduced the frequency of 11720 Kc, with callsign ORU5 for its broadcast in the mornings, and this has replaced 9745 Kc. The Belgian National Broadcasting Service, is using this frequency from 7.15 to 9.00 a.m. The broadcasts are on 11720 Kc. to Europe, 11850 Kc. to South America and 15335 Kc. beamed to North America.

AMATEUR BANDS WITH BILL MOORE

PROPOSED AMATEUR CUTS ARE SEVERE

Radio amateurs are concerned with the suggested cuts in the width of frequency allocations they have enjoyed since the Atlantic City I.T.U. Conference held in 1947. Variations from current band widths would seriously affect communication between amateur stations.

THE proposals for frequency cuts to amateur bands as forwarded to the ITU, Geneva, for inclusion in the Volumes of Proposals are certainly drastic.

These were contained in the FASC (Frequency Allocation Sub-committee) proposals as recommended to the Government and news of them were released early in May by the Postmaster-General, Mr Davidson. An announcement on the proposals was carried over VK2WI on Sunday, May 3, from information provided by Allen A. Fairhall, M.H.R., VK2KB.

If adopted, they will create serious problems to amateurs operating in the already narrow frequency allocations, especially on the bands 7 and 14 Mc/s.

The impact on the growing amateur service could be serious and will undoubtedly influence prospective amateurs from joining the ranks.

Most critical, although all cuts are grave, is the cut of 50 Kc/s. on 7 Mc/s. This band is used extensively for inter and intrastate working and carries 90 per cent of traffic during national disasters.

Already the serviceability of the band has been limited during evening hours by the invaders, overseas, commercial and military services.

The reduction of 100 Kc/s. on the 14 Mc. band from the most used international communications band would make a serious inroad into the frequencies available for useful working. This band, like 7 Mc/s., is so crowded at most times of the day that it is impossible to operate without causing interference to local or overseas stations.

It seems incredible that frequency cuts as proposed should be so drastic. News from the U.K. and U.S.A. indicates no cuts will be made to the current bands resulting from proposals from those Governments.

Surely both these nations have immensely heavier frequency commitments than Australia and pressures from other sources would be greater.

Shown in a panel are the current frequency allocations, the proposed cuts and the service for which the frequencies are required.

Reaction to the proposals is vehement and all avenues of publicity are being explored to ensure that the case for the retention of current frequencies is properly presented.

Radio positioning

RADIO positioning, according to RSGB Bulletin, is the service most likely to gain frequencies from current amateur radio allocations. It is expected that both the U.K. and U.S.A. will propose at the forthcoming ITU Geneva Conference that in certain of the UHF and SHF amateur bands radio positioning (radar and associated techniques) shall have priority. Some restrictions are already in force domestically in the U.S.

The decision, if carried out, is expected to have little practical effect on amateur operation. Where an individual amateur is found to interfere with radio position work a change of frequency within the band will be normally sufficient to eliminate the interference. In isolated cases where a station is located in close proximity to a radar station further restrictions may be found necessary.

The bands most likely to be affected in the U.K. are 426-460, 1215 to 1300, 2300 to 2450 Mc/s. and other bands higher in frequency.

An interesting statement contained therein is to the effect as far as is known the proposals to provide for radio positioning are the only ones going forward from the U.K. likely to affect amateur radio frequency allocations.

No proposals suggest changes in the current HF amateur allocations.

FCC allocations

THE FCC indefinitely postponed their order on the allocation of exclusive CW segments in the 144 and 50 Mc/s. band. These segments were positioned way down the bands away from the low end where CW stations normally operate.

The postponement followed the request of the ARRL who will now provide a staff study of the position and reasons for allocations at the low end of the band. The League will forward the study to the FCC for consideration.

Ham Hop Club

THE Ham Hop Club's main problem at the moment is the fact that there are a lot more hosts available than travellers. To keep the club active more visits have to be made and anyone planning holidays is asked to include some "Ham Hops" in the program.

G3KZR and G3MIK (Cambridge University students) made the first organised inter-Continental "Ham Hop" when they toured the U.S.A. and Canada. The tour was a great success enjoyed by both hosts and travellers.

W zero GDH has provided plates for printing a specially designed card for IHHC QSL's for members. Specimen copies are being circulated

Voice of America

THE Voice of America Amateur Radio programs are now broadcast much more frequently and are repeated on a number of occasions each Sunday.

It appears from various VOA transmitters on all SW bands from 13 to 49 metres and is beamed to all parts of the world from U.S.A., Greece, Germany, Morocco, Ceylon, Honolulu, Philippines and Okinawa. The first transmission takes place at 0600 to 0630 G.M.T. Sundays and takes 15 minutes of the Sunday Report from America program.

Repeats are made at 0700 to 0730, 0800 to 0830, 1200 to 1230, 1700 to 1730 and 2300 to 2330 hrs. G.M.T. Broadcasts are still written and compered by Bill Leonard, W2SKE, and produced by Gene Kern, WTBAK. They provide an excellent insight into the latest on radio amateur affairs in the U.S. Quite often overseas amateur visitors to the U.S. are included and their review of amateur radio in their own country is always interesting.

Current	Proposed	Remarks
1840-1860 Kc/s.	1840-1860 Kc/s.	No change. Not normally issued.
3500-3800 Kc/s.	3500-3700 Kc/s.	100 Kc/s. required for fixed, mobile stations.
7000-7150 Kc/s.	7000-7100 Kc/s.	50 Kc/s required for shortwave broadcast.
14,000-14,350 Kc/s.	14,000-14,250 Kc/s.	100 Kc/s. required for O.T.C.
21,000-21,450 Kc/s.	21,000-21,450 Kc/s.	No change
28,000-30,000 Kc/s.	28,000-30,000 Kc/s.	No change
56-60 Mc/s.	56-58 Mc/s.	2 Mc/s. required for TV
144-148 Mc/s.	146-150 Mc/s.	Band to be moved 1963

N.S.W. ANNUAL MEETING

THE annual meeting of the N.S.W. Division of the WIA was held in April and an excellent attendance noted. President Perc Healy, VK2APO, was in the chair.

It was declared that five members were elected to council for the ensuing year. They comprised retiring councillors Bob Godsall, VK2ARG, Dave Duff, VK2EO, and Bob Luther, VK2ZEL, past councillor Ted Whiting, VK2ACD, and Keith Woodward, VK2ZAU. They will co-opt two additional mmebers to bring council up to full strength of seven members.

The balance-sheet duly audited by Bill Yates, VK2AWY, was adopted. Bill, a resident of Orange, suggested for convenience and speed of handling of WIA accounts, etc., an auditor from the city be appointed. Jim Cummings, VK2PM, was duly elected, to this position.

The Adams Trophy presented to the N.S.W. amateur who contributes the best technical article to "Amateur Radio" was won by Bob Winch, VK2OA, for his writings on overtone oscillators.

The normal monthly meeting followed but the only business discussed covered the election of 18 new members.

The following officers were elected for the year 1959/1960 for the N.S.W. Division at the first council meeting.

President, Dave Duff, VK2EO; vice-presidents, Ted Whiting, VK2ACD, Max Sobels, VK2OT; secretary, Norm Beard, VK2ALJ; treasurer, Keith Woodward, VK2ZAU; chairman of council, Bob Godsall, VK2ARG, councillor Bob Luther, VK2ZEL; O/C, VK2WI Dural, George Rutter, VK2CB. WICEN officer Bob Winch, VK2OA; auditor, Jim Cummings, VK2PM; bulletin officers, Nev Sneddon, VK2WS, and Harry Harris

The outstanding growth of the N.S.W. Division of the WIA during 1959 was reviewed in the annual report drafted by past-president Pierce Healy, VK2APO. Some interesting features were as follows:

The increase in membership was marked, which totalled 1,057 at the end of the war. The net gain in members during the period was 258, including three life, 113 full and 142 associate members.

It was necessary during the year to amend Article 1 of the constitution which restricted the membership to 1,000 members.

The new figure is now 2,000.

The equipment now installed at VK2WI Dural includes two AT14 transmitters, a BC610E 500-watt plate and screen modulated transmitter used as the main 7 Mc/s. unit for divisional broadcasts. A 100-watt 144 Mc/s. transmitter complete with modulation and power supply is also installed.

All the above transmitters can be operated individually or from the console. The console unit includes three AR7 receivers and a 144 Mc/s. convertor.

Broadcasts are provided on 7146, 3573 Kc/s. and 145 Mc/s. and callbacks normally taken on 7050 Kc/s.

Outstanding WICEN exercise of the year was when VHF equipment was taken to Civil Defence Organisation H.Q.s in Sydney, and VK2WI was operated remotely. WICEN stations throughout the State were in direct contact with CDO in Sydney.

The AOCP classes were well patronised and 24 students attended the normal class. Seventy-two members joined the correspondence class during the year and enrolled from all States of the Commonwealth, New Guinea and Norfolk Island.

Conventions were held at Urunga, Gosford, Blakalls and Katoomba. The South-Western zone's annual event was held at Canberra, the Canberra Radio Society acting as hosts. The ninth annual convention of the division was held at Dural, and surpassed any previous show, nearly 300 attending.

The QSL Bureau handled 32,527 cards during the year. The service to non-members was responsible for bringing a number of amateurs within the compass of the division.

Reports on the activity of the Hunter branch and various sections were included.

The full report covered 14 typewritten pages, an interesting review of the extensive activity within the division.

Full members of the division tally well above 50 per cent of the State's amateur and would approximate 80 per cent of licensed amateur, active or taking an interest in amateur radio affairs. Many of the calls listed have not been active or interested for a decade.

The 50 Mc band

THE 50 Mc. band was patchy during April and early May. JA's and some interstate stations showed up on odd days.

A number of overseas countries are still granting further permission to amateurs to use 50 Mc/s. originally granted for use during the I.G.Y. only.

MASTER ELECTRICS PTY. LTD.

A WHOLLY OWNED SUBSIDIARY OF MOTOR SPARES LTD.

KEW MULTIMETER

Size 4in x 2¾in x 1¼in complete with Test Prods. **Ranges, AC and DC Volts** 0-15, 150, 1000.
DC Current 0-150 ma.
Resistance 0-100,000 ohms.
Sensitivity 1000 ohms per volt. An Ideal pocket meter for the serviceman, motor mechanic, home constructor, etc.

Price only £3/19/6

RECORD PLAYER AMPLIFIER

Very compact lightweight. This unit combines a 4½ watt amplifier with two inputs, one for the built-in 3-speed Philips record Player and one for a crystal microphone. Each input has its own volume control. Also two outputs, and one for a separate extension speaker. An on-off switch and tone control are provided. The Cabinet is finished in two-tone leatherette. Ideal for parties or playing records in the home. Well worth 35 gns.

Price only 19 gns.

6in extension speaker in leatherette covered box worth £5. **Our price 69/6.** Crystal microphone to match this unit 45/. **4 Speed Record Player in leatherette** covered case with automatic stop turnover head with crystal cartridge and 2 sapphire needles, plays standard and microgroove recordings. All colours available. Worth 19 gns. **Our price is £13/19/6 each.**
SPRING GRAMO MOTORS, wind-up type, suitable for replacement in portable gramophones etc. Complete with turntable and fittings. **Price only £1/15/. Sound Boxes** to match Spring Gramo motors. **Price 7/6 each.**
Tone Arms. For above. Ivory finish. **Price 6/ each.**
3 Speed Record Player Units consisting of motor and turnover head crystal pick-up 2 sapphire needles. Ideal for both standard and microgroove recordings. Automatic stop. English make. **Price only £9/19/6 each.**
4-Speed Gramo Motors to operate from 230 volt AC supply. Each has control knob with 16, 33, 45 and 78 R.P.M. positions and on-off switch. Ideal for playing all types of recordings. An excellent job, these are brand new and boxed. **Price only £5/10/.**
4-Speed Record Player Units, consist of motor and turnover head, crystal pick-up with 2 sapphire needles, ideal for playing microgroove and stardard recordings. Automatic stop. English make. **Price only £10/19/6 each.**
Magnetic Pick-ups. English made with bakelite arm for 78 R.P.M. records, lightweight. **Price 7/6 each.**
Stereo Record Player Units, 4 Speed English make with turnover crystal cartridge, will play all other types of records as well as Stereo. **Price only £12/10/.**

★ SPECIALS ★ CONDENSERS

1. The following Condensers are available, all in new condition and are guaranteed.

Capacity	Type	Voltage	Price
3PF	Bead Ceramic		9d
.00017mfd	Mica Block	2000 wkg	2/
.00017mfd	Mica Block	4000 wkg	3/
.001 mfd	Mica Pigtail		6d
.001 mfd	Mica Block	5000 wkg	5/
.005 mfd	Paper Block	2500 wkg	2/
.01 mfd	Mica Pigtail		1/
.015 mfd	Mica Block	2000 wkg	2/9
.001 + .005 + .01	Paper Block	600 wkg	1/6
.01 mfd	Mica Block	2000 wkg	2/3
.01 + .01	Paper Block	2000 wkg	3/
.02 mfd	Mica Block	1000 wkg	1/9
.02 mfd	Mica Pigtail	1000 wkg	1/
.025 mfd	Mica Block	2000 wkg	3/
.1 mfd	Block	1000 wkg	2/
.1 + .1 + .1	Miniature Block	600 wkg	1/3
.25 mfd	Paper Tubular	400 wkg	6d
.25 mfd	Paper Tubular	600 wkg	9d
.5 mfd	Paper Block	3000 Test	2/
.5 mfd	Paper Block	700 wkg	2/
.5 mfd	Paper Tubular	400 wkg	1/
1 mfd	Paper Block	500 wkg	1/9
2 mfd	Paper Block	400 wkg	2/3
4 mfd	Paper Block	750 wkg	4/9
4 mfd	Electrolytic	350 Peak	1/
4 mfd	Paper Block	500 wkg	3/6
5 mfd	Paper Block	400 wkg	4/
8 + 8 + 25	Electrolytic	525 + 525 + 40 Peak	3/6
3 + 5	Paper Block	400 wkg	3/9
10 mfd	Electrolytic	40 Peak	6d

★ SPECIALS ★

2. **Job Speaker Transformers** to match Rola or Jensen Speakers up to 7in size. Primary impedances 5000, 7000, or 8000 ohms available. **Price 4/6 ea.**

3. **Switches,** 3 pole 3 position. Yaxley Wafer Switches, used but in good condition. **Price 2/ ea.**

4. **Power Cords** approximately 3 yard twin flex, plastic or rubber and cotton braided available. **Price only 1/ ea.**

5. **Button Push Button Switches.** Each consists of 4 Push type 2 way Switches and D.P.S.T. push Switch. Ideal for intercom, phones and speakers also station selectors on radios etc. **Price only 7/6 ea.**

6. **Indicator Lamps** in bakelite housing. Red or Clear available. **Price only 1/ ea.**

7. **P.M.G. type Relays,** DC resistance of coil 250 ohms. 1—SP and 1—SPDT switch on each. **Price only 5/9 each.**

8. **Dynamic Earphones** complete with headband and cord. DC resistance 100 ohms. **Price only 15/ pair.**

9. **0-10ma. Meter.** Triplett 2in scale round model. Brand new and boxed. **22/6 each.**

10. 21in Picture Tube Masks slightly marked. **Reduced from 25/ to 7/6 each.**

11. 17in Picture Tube Masks slightly marked. **Reduced from 17/6 to 5/ each.**

12. **P.M. 238** Ferrocart Vibrators 12 Volt 6 pin Non-synchronous. Guaranteed in working order. **Only 12/6 each.**

13. P.M. 104 Ferrocart Vibrators 6 volt 5 pin Synchronous. Guaranteed in working order. **Only 7/6 ea.**

Special Notice

All parcels sent Registered Post unless otherwise stated. Postage or Freight must be included with order.

547 ELIZABETH STREET, MELBOURNE — Phone FY0271

Branches throughout Victoria and Riverina

Most of the N.B.S. I.G.Y. stations that operated in South America just outside the low end of 50 Mc/s. have closed down. They were of great value to W stations to check on possible openings to the south. Two stations will continue to operate, OA3AAE. 49.96 Mc/s., and OA3AAF, 49.92 Mc/s.

W6TMI was the first station to come up with a 49-State WAS for 50 Mc/s. Now some station will have to provide a 50-State WAS with the addition of Hawaii to State standing.

Activity on a percentage basis in Japan on 50 Mc/s. is greater than in any other country. Approximately 600 JA's operate on the band, about 10 per cent of the amateur population. Four hundred of these enthusiasts have contacted stations in the U.S. on the band. The JA's hold the DX record for a contact between JA6FR and PY3BW.

They claim too the long path record for the band for a JA3CE-CT3AE contact. The record number of countries listed for the band is 22. One JA quotes the following prefixes on his QSL card—all VK and VK9, DU, ZL, ZL2, KH6, KL7, KG6, KX6, VE6 and 7, W4, 5, 6, 7, 9 and zero, CE, CX, LU and PY.

The ARRL's WAS award is in the news with additional States being created.

The final arrangements for claiming awards under the 49 States tally are as follows:

Contacts with Alaska prior to January 3, 1959, do not count for WAS awards. WAS awards for 48 States will be issued up to July 4, 1959, if all contacts are made prior to January 3. For work after January 3 or for applicants filing a claim after July 4 it takes 49 cards for a WAS claim on any band.

The 144 Mc/s. WAS is getting closer, but the addition of Alaska and later Hawaii complicates the position for amateurs intent on claiming the award.

Leading station is still W9KLR with 41 States QSO'ed, and W9WOK with a tally of 40. The addition of the two new States will delay the need for any specific determination of what actually constitutes a QSO for WAS purposes. Many of the States worked by leading contestants have been by means of forward and meteor scatter; and contacts by these mediums are rather limited.

The first WAS was awarded back in 1936 and the 10,000th certificate was issued to K4UKO at the end of 1958. Seven thousand of these awards have been granted in the last 10 years.

On the other side of the globe, E12W had a good DX season on 50 Mc/s. He contacted 37 of the U.S States during the year (California worked for the first time). E12W also made the first Europe-Mexico contact. Altogether he QSO'ed 305 W's, 21 VE1 and 3's, 1 VO, 1 XE, for a total of 328 different transatlantic stations. The maximum input used at any time was 40 watts.

Another European 50 Mc/s expert, LA9T, did not have a good season.

Openings were few and of short duration. Contacts made were mainly with East Coast Americans but did hear South Americans for short bursts at times.

Harry Hatton

AT the end of April, N.S.W. lost one of its outstanding DX exponents with the passing of Harry Hatton, VK2AGU. Harry in the years just prewar provided a potent telephony signal on 14 Mc/s. that was to become well-known to many G's and W's. He was one of the first amateurs with a rotary beam on that band. Sympathy from all amateurs is extended to his son and family.

Lecturer at the May meeting of the VHF and TV section of the N.S.W. Division was Bob Black, VK2QZ. The President's trophy was presented to Dick Norman, VK2ZCF. The section holds three field or home station events each month and all are well supported.

Ivor, VK3XB, spends a lot of time working American novice stations on the 7 Mc. band. The novices get a thrill from VK contacts on the band. Ivor had ideas of novice WAS award on the band.

Bill, W6AL, meanderings up the north coast of N.S.W. and into Queensland was news on 7 Mc/s. Bill and his wife are enjoying the trip as are the amateurs he is visiting on the way.

A.O.C.P. CLASS

The W.I.A., Victorian Division, A.O.C.P. Class will commence on Thursday, July 30th, 1959. Morse and Regulations are held on Thursday and Theory on Monday evenings from 8 to 10 p.m. Persons desirous of being enrolled should communicate with the Secretary, W.I.A., Victorian Division, 478 Victoria Pde., East Melb. (Phone JA3535 from 9 a.m. to 4 p.m.), or the Class Manager, on either of the above evenings.

NOVA

The Fabulous 2-Speed "DAIWA"

Complete with highest class dynamic microphone, earphone lead.

FOR ONLY **£69/10/-**

ONE ONLY SHOP-SOILED £64/10/-

RUSH — VERY LIMITED STOCK

"NOVA"-COLLARO

All Collaro and Nova features combined!

THE LOWEST PRICED 3 SPEED HI-FI RECORDERS IN AUSTRALIA

SPEED FREQUENCY COMPENSATION ALL PUSH-BUTTON.
AUTOMATICALLY SWITCHED 3-CONTROL.
DOUBLE SENSITIVITY MAGIC EYE. (Maximum/Minimum indication at one glance)
MONITORING WHILST RECORDING.
HI-FI AMPLIFIER FOR PLAYING RECORDS, ETC., AND P.A.
BUILT-IN RADIOTUNER AVAILABLE IN SINGLE ENDED (5.5 WATT) or ULTRA LINEAR PUSH-PULL (10 Watt).

LOWEST PRICE OF ANY HI-FI THREE SPEED RECORDER EVER ACHIEVED IN AUSTRALIA.

You cannot miss this opportunity if you contemplate buying a tape recorder. ALSO AVAILABLE: COLLARO DECK, single or with Pre-amplifier only (INCORPORATING THE AUTOMATIC 3-SPEED COMPENSATION) and Magic Eye level indicator, with or without power supply. Compensation and Oscillator Coils for this deck.

STILL IN THE FOREFRONT

NOVA "STUDIO" PROFESSIONAL

3 speed for the Connoisseur NOVA "SONIC" MIDGET LIGHT-WEIGHT PUSH-BUTTON for OFFICE AND HOME.

BARGAINS:—

2-Speed Decks: Fast forward and rewind. Excellent differential brakes. Guaranteed Frequency Response. Out they go for **£29/5/**
Collaro Deck (one left). new, but slightly scratched panel **£39/15/**

Ferrographs, Grundigs, Vortexions, Ericorde, New and Second-hand.

Write today about "NOVAS" **"ON APPROVAL"** scheme which will enable you to obtain our equipment for a FREE test without obligation to buy

STEREOPHONIC

AMPLIFIERS FOR DISC AND TAPE RECORDERS, DECKS AND HEADS.

10 Watt Transistor Amplifier 12 Volt

50c/s-15Kc/s 4½ x 3¾ x 4 only £34

Ultralinear O/P Transformers

FOR EVERY TYPE OF VALVE, "Nova" pioneered "Ultralinear" in Australia
UP to 12 WATT (2 impedances), £4/17/6. Up to 20 WATT (2 impedances), £6/3/.
Other types on application.
O/P Transformers for Playmaster 1 to 11 and for the
Mullard 3-3, 5-10 and 20-watt Amplifier Transformers Kit Set.

TV TRANFORMERS for R. and H., Philips, A.W.A. Circuits.
TRANSISTOR TRANSFORMERS for all Circuits.
TRANSFORMERS ON NU-METAL,
RADIO METAL and C-CORES.

REWINDS and any type transformers or coil to customers specifications. Call, ring or write for quote on your needs.

TERMS ON LOW INTEREST
For further details contact your dealer or

"NOVA" 311 SUSSEX ST., SYDNEY. BM6138-BM2350.
Also 122 William Street, Sydney

Open Saturday Mornings and week nights.

CANBERRA: CANBERRA ELECTRONICS, 4 Lansborough St., Griffith, A.C.T. X1324
BRISBANE: STARLIGHT RECORDING CO., Penney's Building. B7336.
MELBOURNE: MELBOURNE TAPE RECORDERS, 255 Elizabeth St. MU4598.

SUPPORT AUSTRALIAN-MADE PRODUCTS AND HAVE NO SERVICE OR SPARE PART WORRIES

"CUT OUT HERE"

Please send without further obligation details of 6/59
. . . . . .
. . . . . .
ADDRESS . . . . . .
I enclose LARGE self-addressed envelope and 9d in stamps

SPECIAL PURCHASE! New 5 Valve Dual Wave Radiogram Chassis with 4 Speed Record Changer

THESE NEW DUAL WAVE RADIOGRAM CHASSIS MADE BY LEADING MANUFACTURER ARE EQUIPPED WITH LATEST MINIATURE VALVES AND SUPPLIED WITH 12in ROLA SPEAKER.
THE CHANGER IS THE COLLARO STANDARD 4-SPEED HI-FI WITH TURNOVER CRYSTAL PICK-UP AND SAPPHIRE NEEDLES.

£29/15/-

F.O.R. Packing 10/- extra

VALVE SPECIALS! 50,000 New Valves To Clear

20 for . 20/- EF50, 7193, 954, VR65A Post and Packing 6/6 extra.

12 for . 20/- 1P5, 1Q5, 1L4, 1K5, 1C7, 6H6GT, 955.

8 for . 20/- 6SH7, 7C7, 1J6.

6 for . 20/- 6C8G, 12SK7, 12SP7, 1M5G, 1K7G.

4 for . 20/- 6U7G, 6J7G, 6SS7, 7C5, 2X2/879, 84, 1T4, 41, EBC33/6B6G, 6U5G.

3 for . 20/- EK32/VR57, EL32, 6K8G, 6K7GT, 3S4, 1S5, 6AG5, 1A7GT.

Post & Packing 4/6 extra

ALL VALVES ARE NEW AND MOSTLY IN INDIVIDUAL CARTONS

NEW VALVE SOCKETS

Ceramic EF50 sockets 2/6 ea. American moulded loctal 1/- ea. Octal 8 pin wafer 6/6 doz.
Aphanol 5 pin ceramic 2/6 ea. Aphonal small 7 pin ceramic 2/6 ea. All post extra.

Transmitting Valves

809	5/6
100T.H.	7/6
803	17/6

Post Extra.

NEW CIRCUIT BREAKERS

Westinghouse 240V. A.C.. 8 amp.
10/- Post 3/-.
American 24v., 25 amp.
4/6 Post 1/-.

NEW VIBRATORS

A.W.A. Oak 6V. 7pin synchronous
5/- ea. or 48/- doz.

HEADPHONES

High impedance S.T.C. Headphones good order.
20/- Post 2/6.

NEW HEADPHONE CORDS

2/9. Post 1/-.

FOR THAT C.R.O. or T.V. SET

POST and PACKING—FRAGILE RATE

NEW 5BP1	37/6	N.S.W. 11/-	Int. 15/-
NEW 902	22/6	N.S.W. 5/-	Int. 8/-
NEW 913	17/6.	N.S.W. 2/-	Int. 2/6
NEW VCR 138A, 3in	17/6	N.S.W. 5/-	Int. 7/6
NEW 906/3AP1	27/6	N.S.W. 5/-	Int. 7/6
5BP1 CERAMIC SOCKETS			6/6

NEW POWER RHEOSTATS

I.R.C. 50 ohm 25 watts 8/6. Post 1/-.

NEW VALVES AT BARGAIN PRICES

1C4	3/	6SJ7GT	9/6	1M5G	5/	6F8G	10/6
6J6	12/	6X5GT	10/	1K7G	5/	7C7	3/6
ECH 35/VR99A. Direct replacement for 6J8G	10/	12K8	10/	1L5	9/6	78	7/6
1C4	7/6	6AC7	2/6	6AC7	2/6	EL32	10/6
1L4	4/6	EK32	10/6	6C8G	7/6	6V6GT	12/6
1T4	7/6	6SA7GT	9/6	6SS7	8/6	VR65A	2/6
1S5	10/	6SH7	5/6	6H6	2/6	41	7/6
3S4	10/	1Q5G	5/	6H6GT	1/6	7193	3/6
3V4	12/6	1P5G	5/	6K7GT	7/9	954	2/6
1R5	12/6	1C7G	5/	6U7G	6/6	12A6	10/
1A7GT	9/6	1K5G	2/6	6J7G	5/	EF50	2/6
1D8GT	9/6					811	£1
6A8G	10/6					12SH7	5/
6K8G	9/6					6K7G	4/6
						1C6	7/6
						955	2/6

Please add Postage on All Valves.
SPECIAL PRICES FOR QUANTITIES.

("Mercury" American Made.) These relay counters register from 0 to 99,999 can be supplied with 250-ohm coil 24v D.C. operation.

25/-
Plus Postage.

MODULATORS WITH VALVES

25/-
Post extra on Command Equipment

COMMAND TRANSMITTERS

WITH VALVES AND CRYSTAL
55/- F.O.R.
4 equals 5.3 Mcs., or 5.3 equals 7 Mcs.

DYNAMIC MICROPHONES

Bakelite hand microphone with switch.
15/-. Post 2/6.
Used, but in good condition.
10/-. Post 2/6.

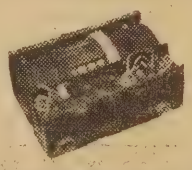
No. 3 CARBON HAND MICROPHONE

New. 10/-. Post 2/6.

SPARK-PLUG SUPPRESSORS

Kit of 6 plug and distributor suppressors. 10/-.

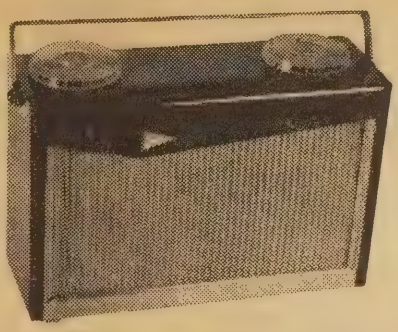
NEW SCR 522 GENEMOTORS



28 volt input D.C. regulated and filtered output filtered D.C. 300 volts at .26 amps; 150 volts at 0.1 amps; 14.5 volts at 5.00. Completely shielded in metal case, 12 x 8 x 5 inches.
Each **27/6**
Used 20/-
Price F.O.R.

METROPOLITAN RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE LM7398
640 KING STREET, ST. PETERS, N.S.W. PHONE LA6087



MAKING R. & H. TRANSISTOR PORTABLE ?

COMPLETE KIT OF PARTS

£26/10/-

Post extra.

SET WIRED AND TESTED £2 EXTRA

INCLUDING 6 S.T.C. TRANSISTORS, R.C.S. COILKIT WITH PRINTED CIRCUITS, ROLA TRANSFORMERS AND 5F SPEAKER & ALL PARTS NECESSARY TO COMPLETE THIS SET INCLUDING ATTRACTIVE & DURABLE TWO-TONE CABINET WITH GOLD TRIM.

Cabinet size 13in x 10in x 6in. Weight 11lb.

PORTABLE TRANSISTOR RADIOGRAM

Complete Transistor Six kit with B.S.R. four speed motor and crystal pick-up and attractive two-tone covered cabinet **£35**

As above but with Seven Transistor kit .. **£37/10/-**

Above sets wired and tested 6 Trans. 55/-. 7 Trans. 75/- extra.

PORTABLE TRANSISTOR-GRAM

Complete kit including B.S.R. Motor and Pick-up (4-speed) and attractive two-tone covered cabinet. **£25**

Wired and Tested, £2 extra. Postage extra.

7 Transistor Portable

Specifications as above but with extra I.F. stage, giving better range and selectivity also has extra coil for connecting to car aerial, making it ideal as a car set or for country locations.

Wired and tested, £3 extra.

£29

Post Extra.

4 Transistor Set

(As described in May "Radio and Hobbies") Complete kit of parts less cabinet. Attractive two-tone covered cabinet 47/6 extra

£13/15/-

Post Extra

CONDENSER SPECIALS

Boxes of 100 new ceramic, mica, paper and electrolytic condensers in values ranging from 50pf mica to 5 400v paper. Values include .0001, .00025, .00075, .01, .02, .05, .1. Also 500 mfd/12v., 10 mfd/40v., 16 mfd/350v., electrolytics

25/- per 100.

Post Extra: N.S.W. 2/6; Int., 3/6.

CONDENSER SPECIALS

100 new mica, paper and ceramic condensers, mixed values

15/-

Post 2/-.

NEW I.R.C. RESISTORS

I.R.C carbon resistors, ½, 1 and 2 watt, in values, 50 ohms, to 5 meg., including many popular sizes 3T, 15T, 20T, 25T, 50T, 100T 250T, 500 T, etc.

(Standard resistor colour code supplied.)

100 for 25/-

Plus 1/6 postage

New Micro-Ammeters

0-100 micro-amp 3in flush mounting

55/-

NEW METER RECTIFIERS. Westinghouse 1 mA rectifiers. 15/-.

ELECTROLYTIC CONDENSERS

New Dubilier pigtail condensers

8mfd 600V 3/9

16 mfd 600V 5/9

Post Extra.

NEW 4in. Per-Mag. Speakers

5T. or 7T. Trans.

25/-

Post. and Packing, 3/6

SPECIAL !

NEW HIGH-FIDELITY 4-SPEED RECORD CHANGERS. TURN-OVER CRYSTAL PICK-UP SAPPHIRE NEEDLES

£10/15/- F.O.I

STANDARD INTERMEDIATE FREQUENCY TRANSFORMERS, 455KC 1¼in square can. Slug tuned. 4/9 post extra

New Power Transformers

40mA prim.; 240v with 230v tapping. Sec. 285 x 285 with 6.3v filament winding 60mA

25/-

Plus Postage, N.S.W., 3/6; INT., 5/3.

New Midget Power Trans.

40mA Prim.; 250v Sec. 225 x 225 with 6.3v Fil. Winding Upright or Flat Mounting Size 2in x 2½in

25/-

2/6 Postage. N.S.W.; Interstate, 4/6.

30mA 240v Prim.; 150 x 150v. Sec. with 6.3v Fil Winding

22/6 Postage, N.S.W., 2/6; Interstate, 3/6.

MICA CONDENSERS

Standard Mica Condensers, small current types .00003 to .005, including most wanted values

10/- per 100. Postage 1/6.

CARBON RESISTORS

New carbon resistors, mixed values Well-known make 10/- per 100 Post free.

NEW POTENTIOMETERS

WITH SWITCH STANDARD SPINDLE.	WITH SWITCH SHORT SPINDLE.	LESS SWITCH STANDARD SPINDLE.	LESS SWITCH SHORT SPINDLE.
25,000 ohms.			50,000 ohms.
100,000 ohms.,	100,000 ohms.	100,000 ohms.	100,000 ohms.
500,000 ohms,	500,000 ohms.	500,000 ohms.	500,000 ohms.
1 meg. ohm,		1 meg.	1 meg ohm
4/6 ea. 42/- doz.	2/6 ea. 24/- doz.	3/6 ea. 33/- doz.	1/9 ea. 16/- doz.

500,000 ohm pots. can be supplied tapped at 40,000 if required, post extra.

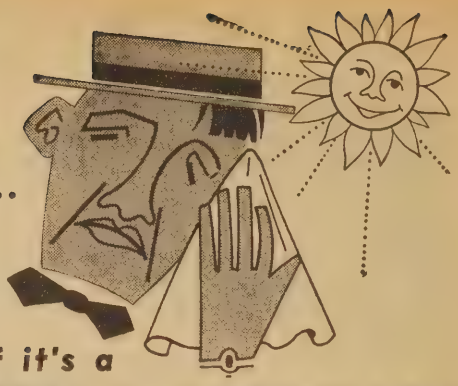
Please address all correspondence to 332 Parramatta Road, Stanmore, N.S.W.

METROPOLITAN RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE LM7398

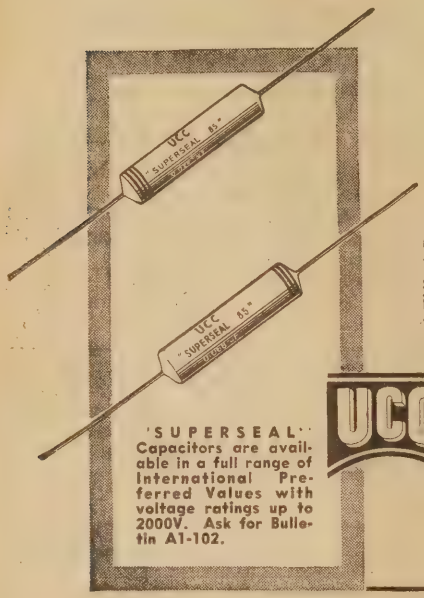
640 KING STREET, ST. PETERS, N.S.W. PHONE LA6087

IT'S NOT THE HEAT, IT'S...



it makes no difference, if it's a

"SUPERSEAL" CAPACITOR



"SUPERSEAL" Capacitors are available in a full range of International Preferred Values with voltage ratings up to 2000V. Ask for Bulletin A1-102.

Designed to withstand the most severe conditions of humidity and high-temperature operation, the UCC "Superseal" range of paper tubular capacitors is ideally suited to high-quality radio, television and electronic equipment. Thermo-setting Polyester end seals ensure an extremely high degree of protection against moisture penetration and allow an upper temperature limit of + 85° C. to be achieved without voltage derating. For the utmost in reliability, always specify UCC "SUPERSEAL" 85.

UCC

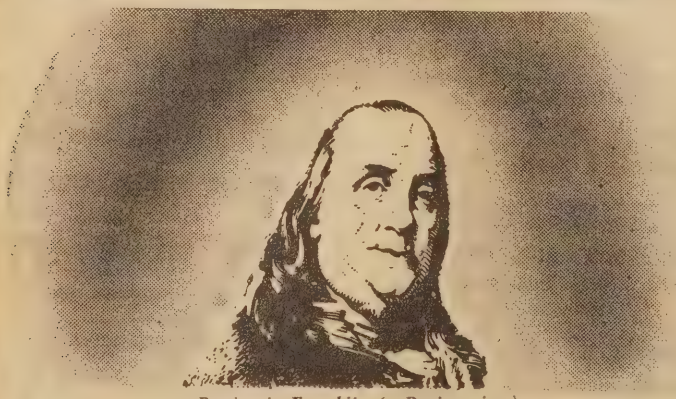
UNITED CAPACITOR CO. PTY. LIMITED

433 Punchbowl Road, Enfield, N.S.W.

YB 0311

MELBOURNE:	U.C.C. Pty. Ltd., 486 Bourke Street.		
ADELAIDE:	Stephen & Co., 83 Grenfell Street.	**N.Z.:**	H. W. Clarke (N.Z.) Ltd., 42 Cable Street, Wellington.
BRISBANE:	Tecnico Ltd., 103 Albert Street.	**TAS.:**	G. A. W. Wood, 46 Brisbane Street, Launceston.
PERTH:	O. F. Gamble, 931 Hay Street, Perth		

WHAT SECRET POWER DID THIS MAN POSSESS?



Benjamin Franklin (a Rosicrucian)

Why was this man great? How does anyone—man or woman—achieve greatness? Is it not by mastery of the powers within ourselves?

Know the mysterious world within you! Attune yourself to the wisdom of the ages! Grasp the inner power of your mind! Learn the secrets of a full and peaceful life! Benjamin Franklin—like many other learned and great men and women—was a Rosicrucian. The Rosicrucians (NOT a religious organisation) first came to America in 1694. To-day, headquarters of the Rosicrucians send over seven million pieces of mail annually to all parts of the world.

THIS BOOK FREE

Write for YOUR FREE COPY of "The Mastery of Life"—TO-DAY. No obligation. No salesmen. A non-profit organisation. Address: Scribe HGH.

The ROSICRUCIANS (AMORC)

BOX 3988, G.P.O., SYDNEY, AUSTRALIA

Scribe H.G.H.
The ROSICRUCIANS (AMORC), Box 3988, G.P.O.,
Sydney, Australia.

Please send me the *free* book, *"The Mastery of Life,"* which explains how I may learn to use my faculties and powers of mind.

Name .....

Address .....

City ..... State .....

Science of Chemurgy

(Continued from Page 19)

base is processed another way it can be formed into lignin plastics.

Walnut shells with their high lignin content, are, therefore, a valuable waste product.

In addition to being a valuable source of lignin, the cutin content of walnut shells gave them a distinction not shared by other waste products. Cutin is a wax-like substance found elsewhere only in the bark and stems of trees. It prevents the evaporation of moisture by the heat of the sun.

This cutin makes walnut shells waterproof so that, when the shells are ground into a fine powder, this walnut flour will not absorb moisture.

Prior to this discovery, ordinary wood flour was used as a filler in plastic ingredients before moulding. This was not waterproof.

USED AS A FILLER

The use of walnut shell flour as a filler improved the process out of sight. The finished plastic was waterproof, could withstand a higher temperature, and thus was a better insulating material. In addition, it was more economical because, unlike wood flour, it did not absorb the resins used in the plastic formulae. Therefore, less of the expensive resins were required in the final product.

The cutin content, being wax-like, gave a glossy finish, and enabled the moulded piece to be lifted more easily from the mould.

Further experiment with walnut shells gave them a further use. Ground to a certain fineness they make an excellent carrier for insecticides.

By mixing the poisonous substance with walnut shell flour, it was found that it was heavy enough to be carried in the air and light enough to adhere to whatever it settled upon.

As a filler for hard rubber products, walnut shell flour is extensively used. It bonds well with rubber in vulcanising processes, and, being non absorptive, it is exclusively used as a filler in the making of vulcanised battery cases.

It is also used as a filler for dynamite manufacture, in linoleum, wood fillers and glues. It cleans furs better than anything else, because it does not absorb the natural oils. It is used for making roofing paper and, mixed with clay, makes good firebricks.

BUILDING BOARDS

Speaking of lignin calls to mind the various hard building boards on the market at the present time. These are possible because of the plasticising nature of lignin. Wood is crushed into a powder by an explosive process. The resultant powder is subjected to a pressing and heating process which converts the powder to a hard rigid sheet with an excellent surface for painting.

The urge given to the chemurgic scientist by the outstanding developments in many waste products is having an amazing impact on farming and forestry. Shells from almonds, peanuts, and the shells and kernels of fruit such as peaches, cherries, and apricots are gaining attention.

audiocraft PTY. LTD.

SPECIALISTS IN ALL TYPES OF

CABINETS

FOR HI-FI EQUIPMENT

We manufacture a wide range of speaker enclosures and complete home HI-FI systems.

SHOWROOMS AND FACTORY: 82 GLENFERRIE RD., KEW E. 4 VIC.

PHONE WA5559 At tram terminus. OPEN SATURDAYS

VACUUM MOUNTED CRYSTALS

for general communication frequencies in the range 3-14MC. Higher frequencies can be supplied.

THE FOLLOWING FISHING CRAFT FREQUENCIES ARE AVAILABLE IN F.T. 243 HOLDERS

6280, 4095, 4535, 2760, 2524

IMMEDIATE DELIVERY AVAILABLE

AMATEUR TYPE CRYSTALS 3.5 AND 7 MC BAND

Commercials—from £3/12/6 each, plus 12½% Sales Tax.
Amateur—from £3/-/- each plus 12½% Sales Tax.
Regrinds £1/10/-

Crystals for Taxi and Bush Fire Sets also Available

We would be happy to advise and quote you as to the most suitable crystal for your particular application either in the pressure or vacuum type holder.

New Zealand Representatives:—Messrs. Carrel & Carrel Box 2102, Auckland

BRIGHT STAR RADIO

46 Eastlake St., Oakleigh, S.E.12, Vic. UM3387

SUCCESS ASSURED

TRAINED MEN AND WOMEN ARE BETTER PAID

EQUIP YOURSELF NOW FOR THE FUTURE. LET US SHOW YOU HOW.

★ We offer you the means of qualifying for the highest positions in Engineering or Commerce, by the simplest method, viz., the Chambers College "EASY WAY" Spare-Time Course at Home.

TROUBLE-FREE POSTAL COURSES

MODERATE FEES, PAYABLE MONTHLY IF DESIRED

Mechanical Engineering
Radio Engineering
Electrical Engineering
Aeronautical Engineering
Civil Engineering
Structural Engineering
Diesel Engineering
Automobile Engineering
Television
Electric Wiring
Building Construction
Clerk of Works
Bookkeeping and Accounts
Salesmanship
Draughtsmanship:—
Mechanical
Machine Design
Aeronautical
Electrical
Building
Reinforced Concrete
Jig and Tool
Press Tool and Die
Builders' Quantities
Surveying and Levelling
Factory Administration
Rate-fixing
Time and Motion Study
Physiology
Languages:—
English, Latin, French
German, Spanish.
Chiropody
Psychology
Massage.

CHAMBERS COLLEGE

614 ST. KILDA ROAD, MELBOURNE.

Established 1885. First in Britain. Foremost Ever Since.

A DIPLOMA IS AWARDED TO ALL SUCCESSFUL STUDENTS

POST COUPON NOW.

TO CHAMBERS COLLEGE (Dept. R.D. 5) I am interested in
614 St. Kilda Road, Melbourne. (State course or courses)

Please forward FREE GUIDE to:—

NAME .....

ADDRESS .....

A.C.E. RADIO

PHONE LA 3845

136 VICTORIA RD. MARRICKVILLE, SYDNEY, N.S.W

636 KING ST., NEWTOWN — LA7008

STEREOPHONIC RADIOGRAM

Sound faithfully reproduced to give utmost realism in your own home. You can hear every instrument with lifelike clarity and full directional effect of natural sound from 2 speaker systems with 2 audio channels synchronised volume and bass and treble boost controls. Designed for the new stereo discs but 100 per cent better sound from your present microgroove or standard recordings.

8-VALVE STEREOGRAM, with Power Supply. On separate chassis. 2 Mullard 3.3 Amplifiers with Synchronised Volume. Bass and Treble controls
Valves, 6AN7, 6N8, EM80, 2EF86, 2 EL84, 5V4, 2 Rola 8MX. Speakers. **£36/15/-**
Frequency response 50 C/s to 10,000 cycles.

STEREO RADIOGRAM KITSETS

5 VALVE
6AN7, 6N8, 6BM8, 6BM8, 6V4
Bass, Boost, Treble Cut
2 Jensen 12in Speakers.
Complete Kitset, including Valves, Speakers. Circuit.
6 watts output.
£29/-/-
Wired and Tested,
£33/10/-

8 VALVE
Dual Wave Stereogram. Octal Series Valves.
2 Jensen 12in Speakers
10 Watts Output,
Bass and Treble Control,
Complete Kitset, including Valves, Speakers, Circuit.
£29/17/6
Wired and Tested.
£33/17/6

PORTABLE STEREOGRAM

MULLARD 2 x 2
Leatherette Cabinet.
2 Miniature Vented Enclosures form lid.
6 Watts Output.
Bass and Treble Controls,
4-speed and Stereo Player.
£42/17/6
With built-in Tuner,
£10/10/- extra

TRANSISTOR PORTABLE

Complete Kitset including Plastic Covered Cabinet and Circuit.
KITSET
6 **£26/10/-** 7 **£29/-/-**
Wired and Tested
£28/10/- **£32/-/-**

STEREO 4-SPEED PLAYER
£14/17/6

STEREO 4-SPEED CHANGER
£17/17/6

AMPLIFIERS

Public Address Range
240v-AC
6 Valve, 10 watt, **£14/17/6**
6 Valve, 25 watt, **£25/7/6**
6 Valve, 40 watt, **£32/7/6**

Battery Operation

6 Valve 6v. 10 watt, **£18/15/**
7 Valve 12v. 12 watt, **£19/15/**
7 Valve 12v. 25 watt, **£24/17/6**

BATTERY—AC OPERATION

6 Valve 6 x 240 10 Watt, **£20/15/**
7 Valve 12 x 240 12 watt, **£21/15/**
7 Valve 12 x 240 25 watt, **£29/7/6**

D.C. TO 240V A.C. INVERTERS

6V Input 40 watts.
12V Input 60 watts.
32V Input 60 watts.
£8/17/6
6V Input. 60 watts, 50 cycles.
12V Input. 100 watts. 50 cycles.
Suitable for Radiograms, Tape Recorders.
£15/17/6

TV I.F. STRIPS

Complete with Valves Aligned and Tested
Your pick from Steans R.C.S. Mahood coils
from £12/10/-

TV TURRET TUNERS

Steans, Philips, AWA, Mullard, Astor
from £12/10/-.

14 VALVE STEREOGRAM CHASSIS

Twin Chassis, Twin Push Pull Hi-Fi Amplifier. 14 watts of wide-range reproduction.
4 Jensen speakers ensure 100 per cent better quality on radio or your present records and superlative quality on the new stereo discs. **£57/17/6**

7 VALVE RADIOGRAM CHASSIS

including Collaro Conquest 4-Speed changer and 12in Speaker, Tuned R.F. Stage and 3 gang **Tuning Condenser** ensures exceptional selectivity and sensitivity in the most difficult country locations. **£36/15/-**

ACE TV KIT SETS

Complete with all valves, picture tube and construction manual.

17in		£99
21in	Q-Plus	£105
14in		£99
17in		£110
21in		£120
R. TV & H.-58		
21in		£110

Wired and Tested
£12 EXTRA

TV ANTENNAE

A complete range from
£4/15/-

Send for full details on Radiogram Chassis, TV and Amplifiers.

TV BARE CHASSIS

with E.H.T. Box and Sub-chassis.
R. TV & H 1957—1958
£1/7/6
I.F. Strip Chassis 5/-

VACUUM TUBE VOLTMETER

Voltage Ranges: DC-3-10-30-100-300. 1000.
Resistance Ranges: 1000-10.000 100,000
1 meg., 10 meg., 1000 meg.
1 p.c. accuracy. To 300 V. and 10 meg. range.
£29/-/-
30K. V. Extension Probe.
£7/15/-

OSCILLOSCOPE

5in Wide Band
10 Valves
P.P.X & Y. Amplifiers
5 Step. Input. Attenuator with voltage reference.
Time Base. 10 C/s to 100K.C.
Band Width. 1 Meg.
£47/10/-

3in Servicescope
6 Valve
3 Step Attenuator
10 V. to 100K.C. T.B.
£37/10/-
Vented Enclosure 1.9CF
To Rola Dimensions for 8 MX Speaker
White Finish
£8/5/-

A.C.E. RADIO

Amplification Communication Electronics

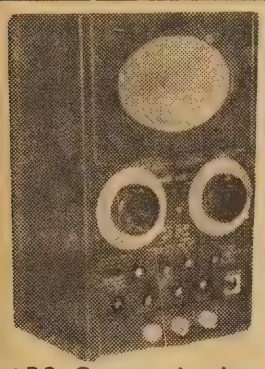
PHONE LA 3845

136 VICTORIA RD. MARRICKVILLE, SYDNEY, N.S.W

AND 636 KING STREET, NEWTOWN — LA7008

EVENINGS and WEEKENDS: "KALUA," Hilma St. Collaroy Plateau — XW5956

DULWICH HILL, UNDERCLIFFE, EARLWOOD, BUS AT DOOR, STOP No. 42



AR8 Communications Receivers

2 valve. Converted to 240v A.C. Thoroughly Tested. Re-aligned. Latest Ovaltone Permag. Speaker.

£34/17/6

NEW VALVES

2C8	12/6	VT502	12/6
J8	17/6	150/30	15/
T501	12/6	6K6	7/6
D21	15/	6SK7	15/
C6	12/6	AV11	3/9
J6	12/6	6K7	5/
A6	12/6	12SJ7	12/6
A4	15/	12SK7	5/
B7	10/	12SL7	12/6
D6	10/	39/44	10/
AG5	7/6	47	12/6
AM5	15/6	828	£2/10/
AM6	17/6	843	£1/10/
H6	2/6	957	10/6
K7	5/	1625	£1
M8	5/	1629	10/
X4	12/6	1619	£1
2AT7	17/6	2050	£1
32	£2/10/	9001	8/6
J5	9/6	RK75	10/
34	5/6	VR75/30	15/
003	12/6	RK48A	£3
J6	15/	954	7/6
17G	7/6	VR105/30	15/
N7	10/	1C7	2/
2A6	2/6	7193	3/6
TW62/6U7	7/6	6B8	12/6
D5	7/6	EL3NG	12/6
V6	3/6	83	10/
F6	12/6	EMI	12/6
R65A/SP41	2/6	866A	15/
X5	10/	6AC7	2/6
Y6	12/6	EF50	2/
Q5	2/6	100TH	5/
E5	12/6	5R4GY	£1
2K8	12/6	6AJ5	9/6
T4	10/	EA50	2/6
S4	10/	1K5	2/6
L4	5/	6SN7	12/6

New Transmitter Valves

09	7/6
11	£1
03	£1/5/
05	£2/10/
50T	£5
500T	£15
04TH	£1/10/
32	£2/10/

NEW C.R.O. TUBES

Suitable for TV Pic. Tubes.

CR 139A, 2¾in	£1 10 0
CR, 138A, 3in	17 6
CR 97, 6in	£2 17 6
FP7 Flying Spot, 5in	£0 17 6
V112	£0 10 0
06	£1 7 6

NEW VACUUM PUMPS

An excellent Low Pressure Air Compressor. 7C.F. per min. 25lb pressure.

£2/7/6

NEW POWER TRANSFORMERS

285 x 285V 60mA	£1 17 6
285 x 285V 80mA	2 7 6
285 x 285V 125mA	3 7 6
325 x 325 150mA	3 15 0
250 x 250 175mA	3 15 0

C.R.O. Transformers

350 x 350v. extended to 1000V. 6.3, 6.3-2.5 4V filaments.

£4/5/.

Vibrator Power Transformers

6V 300 V 125mA	£3 12 6
12V 325V 125mA	£3 12 6

TV Power Transformers

295V 300MA	£6 15 0
295V 400MA	£8 5 0

Inverter Transformers

6V 240V 40 Watt	£3 7 6
12V 240 60 Watt	£3 7 6
32V 240 60 Watt	£3 7 6
750 x 750V 750mA	£7 10 0
240V to 110V 2KVA	£10 10 0

RELAYS

6V, 3-Pole Miniature	15/
1700 SPDT	7/6
1300 SPDT	7/6
500 x 500 SPDT	7/6
12 volts DPDT, 5 amp	£1
12 volts DPDT	12/6
11 volts A.C.	£1
Hi-speed Polarised relay	£2/10/
400 ohm	12/6
Hi-lo Phono Transformers	4/6
Spirit Level Bubbles, mounted	4/6
Canadian Signal Lamps	7/6
Hi-voltage, Lead-thru Insulators, each; 15/ doz.	1/6
Hydrometers, Battery Testers	5/9
Torches, 2-cell, Focusing	6/9
Multi-Strand 4-Core Cable, yard	1/
100 yards	£2/17/6
Tx Var. Condensers, 300 pf.	£1/5/
60 pf with Vernier	£1/1/
30 pf	10/
Throat mikes, new	3/6

OIL FILLED CONDENSERS

.5mfd 600V.	3/6
2mfd 600V.	6/6
.2mfd 2500V.	15/
1mfd 600V.	6/6
.4mfd 600V.	6/6
4mfd 4000V.	35/

NEW RESISTORS

100 assorted, 40 Values.

8/6 Postage 2/6.

NEW CONDENSERS

25 PF. to 30 MFD.

100 assorted. Mica Paper Electro.

18/6

Postage 3/6.

GENEMOTORS

Input	Output	
24v.	250v. 100mA	£1 0 0
24v.	550v. 375mA	£2 0 0
24v.	250v. 60mA	£1 5 0
12v.	500v. 350mA	£8 10 0
12v.	1200v. 200mA	£6 10 0
24v.	250v. 100mA. New	£2 0 0
12v.	235v. 50mA	£2 15 0
12v.	350v. 50mA	£2 15 0
24v	540v. 200mA. New	£2 15 0
24v.	300v. 205mA New	£2 15 0

NEW 24V MOTORS

Series wound Hi-speed miniature, 12,000 R.P.M. £2/10/

Shunt wound with gearbox, 2 speed and 5 and 25 R.P.M. £2/10/

NEW AMERICAN

HI-FI HEADPHONES LIGHTWEIGHT PADDED UNITS

£1/17/6

Used Headphones, as above. Tested. Perfect order.

£1/7/6

Postage 2/6.

NEW 24 to 32V DC

Vibrator Power Supplies

Regulated, Filtered, 125V DC

£1/17/6

VALVE & CIRCUIT TESTERS

Transmission Products Units. 240 A.C. 6v D.C. Includes Socket Modification Panel, Valve Charts. Tested. Perfect order.

£22/10/-

MINIATURE HI-POWER MOTORS

With Gearbox.

100 to 1 reduction, 24v. Reversing. Ideal beam swinging unit.

£2/17/6

New Smith Aircraft CLOCKS

8-day movement. Cost Govt. £28.

2¾in	£4/15/
2¾in with sweep hand	£5/15/

New Coils and Intermediates

Standard or miniature to suit all valves.

Coils B/C, 455 KC	9/6
Coils S/W, 455 KC	9/6
Inters	11/6
Loop aerial coils	9/6
Slug tuned H.F. coils to suit 44 meg.	4/6

TELEPHONES

Standard P.M.G. Type.

Pedestal Magneto Phones. Tested. In perfect order.

£6/10/-

NEW R.F. METERS

0 to 1 amp. 0 to 350mA.

10/6

Used meters as above, 7/6.

Postage 1/-.

WANTED

Communications Receivers, Test equipment, P.A. Gear, Large or Small surplus stock. Best prices. Call, write or phone any time.

12V Lighting Plants

Johnston 300 watt direct coupled, in 1 H.P. petrol engine. Tested. Perfect order.

£36

NEW VALVE SPECIAL

Cartons of 50. Any type or assorted per carton

6AC7, EF50, 6H6, CV6, 7193, 1M5 1K7, 1Q5, EA50, VR65A

£6/-/- PER CARTON

NEW 3BZ TRANSMITTERS

12v. operation. 2 to 10 Megs. Air tested. Perfect order. Complies with P.M.G. requirements. For small ships, bushfires and all other services.

COMPLETE WITH 1 CRYSTAL.

£32/10/-

AMERICAN WALKY TALKY S36

Complete with Valves and Circuit. Good condition.

£4/17/6

Postage, N.S.W., 7/6, Interstate, 10/

MATCHED CRYSTAL & COIL SETS

For 536. Walky Talky

£7/-/-

Postage 2/6.

128 TRANSCEIVERS

2 to 4½ Megs. Battery Operated Pack Set.

Complete with Valves.

Crystal Controlled and V.F.O.

£5/10/-

522 TRANSCEIVERS

Complete with Valves.

Excellent Condition.

£12/10/-

522 Receivers Complete with Valves

£5/17/6

522 Transmitters. Complete with Valves

£7/15/0

NEW 2V ACCUMULATORS

70 amp Hour, Dry Charged, Hard Rubber Case.

15/-

ROTARY CONVERTERS

24v, D.C. Input. 240 v. AC. Output. 150 Watt. 50 Cycle

£17/10/-

32 VOLT D.C. INVERTERS

240v. AC. 50 Cycle, 100 Watt.

£17/10/-

Valradio.

CASH & CARRY SPECIALS MARRICKVILLE

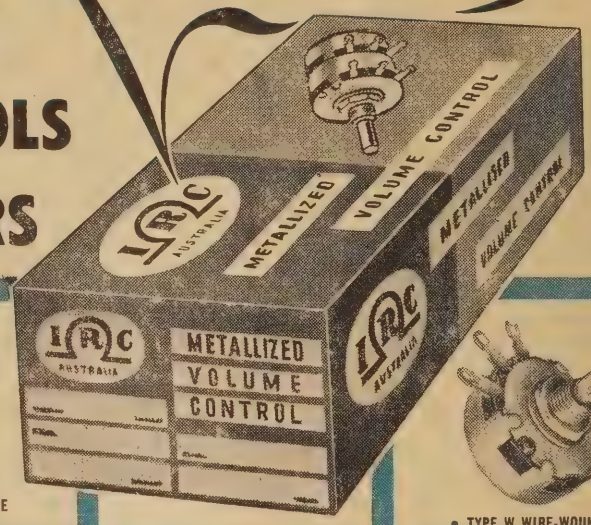
Please. No Mail Orders for these.

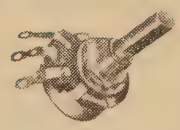
522 Transceivers, incomplete	£2/5/
English IFF. Units, 8 valves, incomplete	12/6
Indicator Units, less Valves	4/6
3in CRO Tubes	8/11
5in CRO Tubes	9/6
Type 34 Generators	£1
522 Genemotors	17/6
75 ohm Co ax, 10yd Min. per yd	8d
Telephone Hand Generators	4/6
12 volt Cutouts, 30 amp.	3/6

I.R.C. AUSTRALIA

METALLIZED VOLUME CONTROLS AND WIRE-WOUND POTENTIOMETERS

LOOK for the BLUE and GOLD carton!





• TYPE Q MINIATURE
(Single without switch)

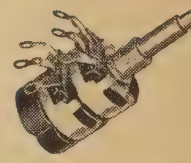
• TYPE Q MINIATURE
(Single with switch)

• TYPE W WIRE-WOUND

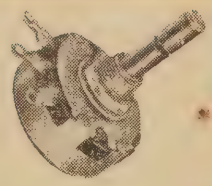
• TYPE Q MINIATURE
(Ganged without switch)

• TYPE Q MINIATURE
(Ganged with switch)

• TYPE Q MINIATURE
(Concentric without switch)

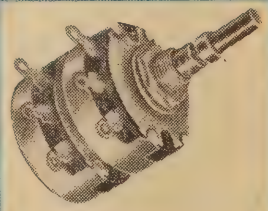


• TYPE Q MINIATURE
(Concentric with switch)



• TYPE CS (Single without switch)

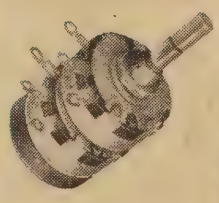
• TYPE CS (Single with switch)



• TYPE CS (Concentric without switch)

• TYPE CS (Concentric with s

• TYPE CS (Ganged without switch)



• TYPE CS (Ganged with switch)

I.R.C. makes more different types and sizes for a wider variety of applications than any other Volume Control and Potentiometer manufacturer in Australia.

Ask your local supplier for the new red I.R.C. leaflet.

Sole Australian Agents—
Wm. J. McLellan & Co. Pty. Ltd.
126 SUSSEX STREET, SYDNEY. BX1131
(50 yards north of King St.)

HERE'S YOUR ANSWER, TOM!

(Continued on Page 79)

ribute the sound to a number of points imultaneously or radiate from a single oint.

When one or more speakers are con- ected in parallel, their total impedance vill be the impedance of one unit divided y the number of units, assuming that he speakers are of identical impedance. This means that, if four speakers are connected in parallel, and if each has n impedance of, say, 15 ohms, then heir combined impedance will become .75 ohms.

It is obvious that, unless the secon- lary impedance of the output trans- ormer is made to suit this new im- edance, a mismatch will result. Most utput transformers, however, have taps n the secondary winding to provide a hoice of at least two impedances.

Now let us take the first instance of nultiple speakers feeding sound to a umber of points simultaneously. If any listance is to be covered, then the nner connecting lines will introduce nwanted resistance in series with the oice coil, resulting in a power loss as ong as resistance is low.

As a rule, this loss can be ignored, rovided the DC resistance of any one air of leads is not greater than, say, third of the resistance of the speaker oad which it feeds. Thus, 5 ohms of esistance would not matter much in a ine feeding a 15-ohm speaker, but it vould seriously reduce power to a -ohm speaker.

LINE IMPEDANCE

Where line resistance is likely to be problem in any case, it is usual to fit ach loudspeaker with a transformer of ratio such that it steps the voice coil oad impedance from a few ohms to n apparent value of a few hundred hms. The amplifier is then provided vith an output transformer having a econdary winding of the same general mpedance and the two can be con- ected by quite long lengths of line, vithout DC resistance becoming a pro- lem.

With such an arrangement it is neces- ary to keep in mind that the rule re- arding impedances in parallel applies to ransformers as well. In other words, f four transformers are connected in arallel each will need to have an impe- lance of four times the nominal line mpedance.

Although the above arrangement will unction satisfactorily it is often simpler o produce speaker-to-line matching ransformers with one standard impe- lance of 500 or 600 ohms and to pro- ide taps on the output transformer to natch a number of these units con- ected in parallel. This is the arrange- ment that you are likely to meet with nost.

Speakers may be connected in parallel o radiate sound from a single point. Numerous advantages are claimed for his arrangement in preference to a single peaker.

Besides dividing the output evenly among the speakers, and thus preventing overload of a single unit, it is possible to obtain a smoother response than from a single speaker because resonances are seldom identical and peaks and dips tend to cancel themselves out. The sound source becomes broader also.

Finally we come to the multiple speaker installation in which the individual speakers are called upon to handle a limited frequency range progressively so that between them they cover the full frequency range.

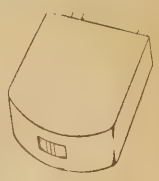
Such installations seldom use more than three speakers. A bass speaker, a middle speaker and a tweeter comprise the lineup. These units are connected through a crossover network which is arranged so that bands of frequencies are channelled to the appropriate speakers and the load presented to the amplifier is fairly constant.

A point to note regarding such an arrangement is that very little benefit will result from using ordinary speakers, particularly the smaller variety. The speakers should be special types, designed to handle the frequency range which will be fed to them through the crossover network.

Nevertheless, some variation of the above is permissible to use units already on hand. The bass speaker, for example, could be a full frequency range unit, to which a middle speaker and tweeter are added. The middle speaker need not have a wide response provided it is a reasonable match, both with regard to impedance and sensitivity, and is free from bad peaks in its response.

The tweeter, too, could be an all-purpose speaker provided it is capable of reproducing the upper register. But for the best results a special unit is to be preferred.

L. B. PRODUCTS NEW MINIATURE half-track TAPE HEADS Types H4 & EH4



Universal high impedance tape heads for replacements, in commercial recorders, wide tape records, etc. Main features are:
Deep-drawn one-piece mu-metal case for maximum magnetic shielding.
Miniature size, 0.7in wide, 0.375in high, 0.75in deep.
Gap flush with curved front of case, permits recording on any width tape.
High impedance astatic windings 9mV output at 7½in per sec.
Wide range response. .0002in gap.
NOTE: Type H4 and EH4 are NOT suitable as replacements for other L.B. Products tape heads, the full range of which remains unchanged.

RETAIL PRICE LIST:

Ultron 15, 15T, 15L (Record-play high impedance, extra range, .00017in gap)	£9 13 6
Ultron 15H, 15HT, 15HL (Medium impedance, extreme range, .00017in gap)	£9 13 6
Ultron 15S, 15ST, 15SL (High efficiency record, .00025in gap)	£9 13 6
HE2, HE2T, (Record-play, commercial quality, .0002in gap)	£6 3 0
EU, EUT, EUL (High efficiency erase)	£5 7 0
H4 (Record-play) and EH4 (Erase) Miniatures	£5 2 0

Note: "T" denotes upper half track, "L" lower half track, all others full track (except H4 and EH4, which are half track).
Send 4/ postal note for booklet, "MAGNETIC TAPE HEADS," containing full details L.B. Products tape heads, hi-fi circuits, etc. A free copy with every head.

Available from Homecrafts Ltd., 290 Lonsdale St., MELBOURNE.
A. G. Healing Ltd., 58 Flinders St., ADELAIDE.
A. E. Harrold Ltd., 123-125 Charlotte St., BRISBANE.

Manufactured solely by:

L. B. PRODUCTS

95 McDonald Street, MORDIALLOC, S.12, VICTORIA. XY1596.

ROYCE DISC RECORDING EQUIPMENT

HI-FI CUTTING HEADS, HOT STYLI, AMPLIFIERS
Labels, Stroboscopes, Turntables, Blanks and All Accessories for the Recordist. Write for Catalogue of Prices.
VIC. BOX 5041Y, G.P.O., MELBOURNE. FB2592.
ROYCE RECORDING SUPPLIES, 291 EXHIBITION ST., MELB.
S. A. SCOTT SALES, 99 CURRIE ST., ADELAIDE, LA1201, ML4919.

TELESCOPES

30 x 40 coated lens with tripod. Suit rifle clubs, etc. Length 28 inches, weight 1½lb.

£7/19/6

Post 4/6; Int., 5/10.

TRIPODS

EX-ARMY.
BRASS TELESCOPIC DIRECTOR OR INSTRUMENT STAND.

£6/10/-

Each.
Freight payable at nearest attended Railway Station.

FIBRE PULLEYS (AMERICAN)

BALL-BEARING

1 3/8in diam., ¼in shaft. 30/ doz.
1¾in diam., ¼in shaft. 42/ doz.
2 3/8in diam., 3/8in shaft. 54/ doz.
3½in diam., 3/8in shaft. 66/ doz.
Add postage.

COPPER WIRE

BRAIDED.
Ideal Aerials, etc.

6/11 per 100 ft.

Post N.S.W., 2/6; Int., 3/11.

OIL PRESSURE GAUGES

New. Suit cars, trucks, boats, stationary motors, etc.
0-150lb per sq. in.

£1 each

Complete with tubing.
Post N.S.W., 2/1; Int., 3/3.

P8 COMPASS

Liquid filled. As new.
Ex-R.A.A.F. Ideal for small boats, etc.

£3/15/- each

Post N.S.W., 4/5; Int., 5/10.

PRISMATIC COMPASS

Ex-Army. LUMINOUS. Guaranteed Correct.

£7/15/- each

Post N.S.W., 3/: Int., 4/.

TV ANTENNA KIT

SIMPLE, DO IT YOURSELF
Complete with tubing and suggested diagrams. Instructions supplied.

£3/9/6

Shop sales only.

VOLTMETER

Pocket Size.
0 to 15 volt D.C. and 0 to 220 volt D.C., with probes. In waterproof Canvas Case.

33/6 each

Post 3/4; Int., 4/6.

DIRECTOR DUMPY LEVEL WITH TRIPOD

£22/10/-

Freight payable at nearest attended railway station.

MAGNETO

12 cylinder platinum points adaptable to 4, 6 or 12 cylinder marine car or tractor engines

£4/10/-

Freight payable at nearest attended railway station.

TELESCOPES EX-Army

Ottway of London.
With variable power adjustments. Length 26in. Weight 12lb

£12/10/-

Freight payable at nearest attended railway station.

LENSES

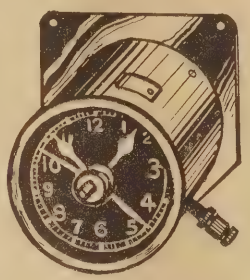
PLANO-CONVEX.
2 3/8in diam New 10/ each
Add postage.
Also assortment prisms, lenses, eyepieces, gears, etc.

GUNSIGHT COLLIMATOR

Contains Acromatic Lens, 1 7/8in diam. 4½in F.L., front silvered diagonal eliptical mirror, two worm traversing gears, sundry tubes, connector mirrors, etc.

27/6 ea.

Post, N.S.W. 3/11; Int. 6/3.



AIRCRAFT CLOCKS

SMITHS 8-DAY

£3/19/6

Ex-Rolls-Royce Merlin Aircraft. With start of trip indicator. £1 extra
Post 3/1; Int. 4/3

VALVES NEW

1R5	12/6	6J6	15/-
1T4	10/	6AG5 ..	7/6
1S5	10/	9006	15/-
3A4	12/6	837	9/6
6C4	9/6	83	9/6

Add postage.

METERS

In Polished Wooden Case and Leather Carrying Case. Siemens, ex-Army
Original Cost £28.
Dimension 7in x 7in x 4in
0 to 1 Milliamps, D.C.

£5/5/-

0 to 50 Amperes, A.C.

£7/5/-

Post, N.S.W., 6/2; Int., 9/6

HEADPHONES

High Impedance. Suit Crystal Sets Lightweight. American.

22/6 pair

Post. N.S.W., 2/1; Int., 3/3.

AIR SPEED INDICATORS

NEW

8/6

Post., N.S.W., 2/1; Int., 3/3.

WALKIE TALKIE BATTERIES

Suit CSR 536.
One H.T. 103½ one L.T 1½V

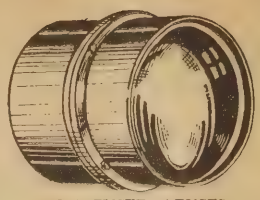
15/- pr.

Post N.S.W., 3/2; Int., 4/7

MANIFOLD PRESSURE or VACUUM GAUGE

£1 each

NEW.
Post., N.S.W., 2/1; Int., 3/3.



CONDENSER LENSES.

3½in WITH CELL.

£3/15/-

Reflector Mirror, Lens Lamp-holder, 35/ extra.
Post 4/2; Int., 5/7.

RANGE FINDERS

Horizon and Bubble Type.
Mark IIIB.

Complete with Leather Case.
Dimensions, 9in x 4in x 2in.
Ex-R.A.A.F..
ORIGINAL COST £30.

PRICE 35/-

Post, N.S.W., 3/2, Int. 4/7.

TRANSFORMER AND RECTIFIER UNIT

Ideal for relay operating. Input 240V. Output 2, 10, 12V D.C., 41, 57 V. A.C.

35/- post N.S.W. 4/11; Interstate 7/3.

TRANSCEIVERS

2-Way Radio
No. 22 without power supply, £4/10/-.
No. 128. 2 to 4.5 megs., Ideal ship to shore, fire-fighting etc. £12.

WHIP AERIALS

Ideal for car or TV antennas or blackfish rods, 13ft in 12in sections.

19/6

Post 1/9, Int., 2/9.

GENEMOTORS

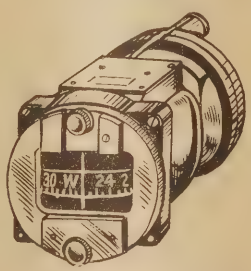
D.C. Input 28v — D.C Output 250v

30/- each

Post, N.S.W., 3/11; Int., 4/7.

MICRO SWITCHES 5/- EACH

Add postage.



Dashboard COMPASS

Small ships. Pioneer American Liquid Damped with Light.
Also suit as car compass

£7/15/-

COMMAND RACKS

Receiver 3 tier 19/6 ea.
Transmitter 2 tier. 15/ ea.
Post., N.S.W., 2/3; Int., 4/3

AIR TEMPERATURE GAUGE THERMOMETER

0-30 minus C 0-50 Plus C.

£1

Complete with tubing.
Post., N.S.W., 2/1; Int., 3/3.

BOOSTER COILS

For racing enthusiasts.
12v Bendix new type 512 Platinum Points

22/6 ea.

Post: N.S.W., 2/1; Int., 3/3.

SEARCHLIGHT REFLECTOR MIRROR, 3ft PARABOLIC. Ideal Solar Heat experimenters. Hot water systems. etc. Also makes splendid Wall Mirror, especially when Fish Bowl or Flowers are placed in front. Has pleasant reflection effect.

Original cost. £80
SPECIAL PRICE

£5/15/-

Sorry, no Mail this line.

Mechanical REV. COUNTERS

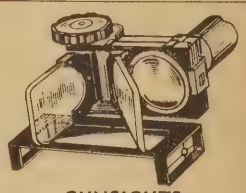
BENDIX.
New, 0 to 3000 r.p.m

£4/19/6 each

or complete with flexible drive.

£6/15/-

Post. N.S.W., 3/; Int., 4/6.



GUNSIGHTS

Contain these lenses:
1 Lens 1" Focus ½" diam.
1 Lens 1 11-16 Focus. 1¼" diam.
1 Air spaced lens 1¼" diam
1 Filter Lens, 1 Graticule
1 Lampholder.

18/6 each

Post N.S.W., 2/1; Int., 3/3.

FIELD STRENGTH METER

OUTFIT.
BRAND NEW
COMPLETE.
100 to 155 m/Cs.
With 0-1 internal/external shunt meter, tools, battery box, signal generator and instruction book in dovetailed wooden case

£17/10/-

Freight payable at nearest attended railway station

WALKIE TALKIE 2-WAY RADIO

Complete except for tank, coil, and crystal.

£4/19/6

Post: N.S.W., 4/2; Int., 5/7

ANGLE TELESCOPE

Can be used as Astronomical Finder or Prismatic Finder or Prismatic erecting eyepiece for high-powered Telescopes.

£3/5/-

Post 3/6

TELEPHONE CABLE

BRAND NEW, NYLEX ROTPROOF COVERED.

£4/17/6 per mile

Freight payable at nearest attended railway station

DEITCH BROS.

70 OXFORD STREET, SYDNEY Between Crown and Riley Streets. City

ANSWERS TO CORRESPONDENTS

P.C. (Haberfield, N.S.W.) asks if the 8 valve television receiver mentioned in the August, 1949 issue Technical Review article would be suitable for use in Sydney.

A. Adaptation to 240 volt operation would only be a matter of a different transformer primary winding but we doubt if the rest of the circuit would give satisfactory pictures by modern standards. Note that a separate sound receiver is also required so that the total number of valves required for complete TV reception is more than eight.

I.C. (Ringwood, Vic.) writes to tell us of the various projects he has successfully completed so far and to ask us what we think he should tackle next.

A. Judging from the wide variety of your projects so far I.C. we think a TV set might be in order. Quite seriously though, it is difficult for us to advise in this regard, since so much depends on what you feel you need most. However, since you seem to have been successful with several fairly complex units, we feel that you should have no qualms about tackling almost any project you fancy.

B.C. (Ashgrove, Qld.) is interested in the Basic three receiver which was described in the issues for May, 1956 and November, 1958, but wonders if we can suggest any other receivers which could be built from old parts.

A. The following is a list of sets which use old war disposals parts and the circuits for which can be obtained through the 2/ query service. (1). DX Junior (three valves). (2). 50-Three (uses 2 EF50 valves). (3). Basic Four (superhet). (4). 50-Four TRF using 3 EF50s). (5). Basic Five (superhet).

H.R.D. (Parramatta, N.S.W.) wants to know if we have published any information on stereophonic sound and where he can obtain constructional details of such equipment.

A. We have published many articles on this subject, both general and constructional, and it would be impractical to list them all. However, two typical designs are the Simple Stereo Amplifier of July, 1958, and the Playmaster Stereo Amplifier of January, 1959. Both copies are available from this office.

P.V. (Waitoa, N.Z.) wishes to build the Transporta Six or the Transporta Seven, but is worried about the difficulty of obtaining the specified transistors.

A. The transistors and other parts you require would be available from our advertisers, but you probably would have difficulty in obtaining the currency to purchase them in this country. The minor components should not present any problem locally, but it would be best to make quite sure if the supply position of the more specialised components first. The OA85 probably could be used without difficulty.

S.C. (no address) sends in a lengthy discussion of the vortexion theory.

A. Many thanks for your letter but we regret that we are not able to make use of it. The available space for long articles has to be allocated to matters of more immediate interest to our readers.

R.D.C. (Mandalla, S.A.) asks the connections to the OC51 point contact transistor. He also gives some interesting information about his activities in the local bush fire network and amateur radio generally.

A. The case of the OC51 is connected to the base the straight wire to the emitter and the bent wire to the collector. However, we doubt if it would be of much use bush fire transmitters because of the frequency rating. The current amplification factor is 3 db down at 1.5 kc/s. However, we would be interested to hear about the equipment you finally develop and, if it operates satisfactorily, consider it for inclusion in the "Reader Built It" section of the magazine. The 1T4 would work satisfactorily with a 45 volt HT supply and the difference in performance with a 90 volt supply would not be so very great, particularly with regard to signal-to-noise ratio. Best of success with your amateur radio projects.

R.M. (Bundaberg, Qld.) has designed a two transistor receiver with a ferrite rod aerial but finds that it operates satisfactorily only when an external aerial is connected to the top of the coil. He is operating a speaker. Also, the regeneration control does not function.

A. A two transistor receiver could only be expected to operate headphones as a general rule and the overall amplification would not be high enough to allow full output when the pickup device is only a small ferrite rod. Better results could be obtained from the three transistor receiver described in the March, 1959 issue and we can recommend this as a simple and cheap way of obtaining good results with a speaker. Overall amplification would be appreciably better but the ferrite rod could only be expected to provide satisfactory reception on close stations. The set cannot be expected to give optimum gain and selectivity unless the regeneration is working efficiently. Your circuit appears to be in order and since you have tried reversing the reaction winding, the best we can suggest is that you try a greater number of turns on the reaction winding.

R.G.B. (Sunbury, Vic.) asks us to supply an explanation of the Quantum Theory.

A. We regret that we are not prepared to discuss so complex a subject in the query section of the magazine and the best we can do is to refer you to one of the standard textbooks on modern physics.

G.W.C. (Orange, N.S.W.) wants to know if we plan to describe a transistor operated photo-flash unit, since he finds that the shelf life of available batteries is too short. In fact, he has quite a number of comments to make on this subject.

A. We have considered the subject you mention, G.W.C., and may do something in the near future. However, we have not been impressed with commercial versions of the transistor units, since none of them have a capacity much above 20 joules (in spite of extravagant claims to the contrary) and the available light output has been condemned by our own professional photographers. Unless we could produce something quite as we would rather put the idea aside. We appreciate your comments regarding batteries in general, but we would suggest, in all seriousness, that you write to the makers concerned. We feel sure that any constructive criticism will be courteously received.

R.B.P. (Burra) is worried about alignment problems when no generator is available, and raises the point concerning correct setting of the IF transformers.

A. Alignment instructions usually suggest that if IF transformers be adjusted first, when a generator is available, but left until last when the job has to be done from broadcast signals alone. However, in all cases where no instruments are available, the worker has to rely on the fact that IF transformers normally are supplied adjusted very close to the 455 Kc. It should not be necessary to adjust them more than is required to compensate for the stray capacitance of the wiring. It also should be appreciated that there is no sure way of knowing what frequency the converter is delivering, and the fact that tracking appears to be correct will not guarantee that the IF is more than approximately correct. This is particularly so with modern coils which have a large range of inductance as set by the core.

Summing up, we repeat that it is not possible to guarantee the correct IF unless the IF transformers as received are correctly set. However, since this normally is the case, it is possible, in practice to achieve quite good results.

D.E. (Gundagai, N.S.W.) writes to tell of his recent experience in sitting for the A.O.C.P. exam. In particular he is puzzled about the paper (January, 1959), which we published in the April issue, since it is not the same as the one presented to him for the same exam.

A. Sorry, D.E., but we cannot offer any explanation. The paper we published was most definitely one handed out to a colleague who sat for this exam. We can only assume that different papers were issued at different centres, though just why this should be so, only the P.M.G.'s Department could explain.

E.L.S. (Villawood, N.S.W.) writes to tell us of some of the experimental work he has been doing and to express the hope that he may be able to forward some of these ideas to us in the near future for publication and the benefit of other readers.

A. Many thanks for your interesting letter, E.L.S., and we are glad to learn that you are still able to take such an active interest in matters electronic. We would be very happy to receive any suggestions and ideas from you and, if suitable, to publish them.

J.J.R. (Largs, S.A.) writes to tell us of the results he has had with a simple receiver consisting of a crystal detector plus an amplifier using a single transistor. He reports hearing American, New Zealand and Indonesian stations as well as Australians on the shortwave bands.

A. The results certainly appear to be very good, but must be due partly to a good location and a good aerial. We would expect the three-valve set you have in mind to do a good deal better. By the way, we cannot reconcile the coil data and frequency ranges you have given.

K.T. (Cheltenham, Vic.) asks about the electronic ignition analyser which was described in the November, 1958 issue.

A. This article was reprinted in full from the July, 1958, issue of "Radio and TV News." Therefore, you will not find any further information by turning up the source.

B.E.E. (Wakunna, S.A.) asks if it is practical to operate a television receiver from an engine driven alternator and what power level would be required.

A. A good television receiver should be designed so that the picture will be satisfactory even if the power supply frequency varies appreciably from the field frequency as set at the television transmitter. However, council supply mains are normally fairly close to 50 cps, which minimises the effect of any interaction between mains ripple and the picture. An accurate governor on the alternator may therefore be helpful with certain types of receivers, but less necessary with others. For the sake of the power transformer, the frequency in any case should not be allowed to fall much below 50 cps. Although we have not carried out any tests with our own receiver along these lines, we feel that it would be as good as most commercial receivers in this regard. A power output of 500 watts would cover all likely receiver requirements. After making normal efficiency allowances we would say that the engine should be able to deliver at least 1.5 h.p. If a petrol engine is used, it may be necessary to include suppressors and even go to the trouble of completely shielding the ignition system. If your 32-volt power is plentiful, it may be better to consider a 32-volt to 230-volt inverter. We remember that such machines were available from disposals sources.

The Radio, Television and Hobbies Query Service

All queries concerning our designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, RADIO, TELEVISION and HOBBIES, Box 2728C, GPO, Sydney.

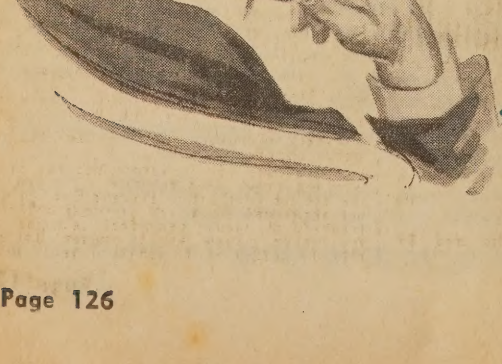
Note that we do not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

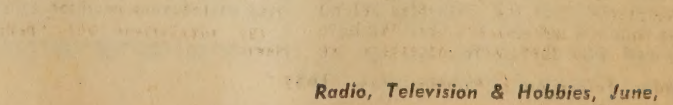
Perfect FOR STEREO

One of the problems which the music lover encounters when deciding to change over his equipment from monophonic to stereophonic reproduction is the amount of living-room space which will be taken up by an adequately baffled loudspeaker for the second channel. Besides seriously encroaching on the floor area, the conventional size enclosures required for 12 inch loudspeakers also introduce placement problems which can prevent good stereo reproduction. It was to overcome these drawbacks that Rola developed the new 8 inch Model 8MX and designed a compact enclosure for use with it.

The frequency range of the 8MX is conservatively stated to extend from 60 cycles per second to 10 K.C., but when used in its special enclosure—its capacity is less than 2 cubic feet—the 8MX adequately reproduces the full tonal range from the organ's deep notes to the high frequencies of the cymbals, triangles and maracas.

Full details of the 8MX and constructional information on the Rola-designed vented enclosure for use with it are available, free and post free, from the Sales Department, Rola Company (Aust.) Pty. Ltd., The Boulevard, Richmond, E.1, Victoria.





Cross-over Networks

(Continued from Page 83)

The electrical structures shown in Figs. 3 and 5 for the two-way and the three-way networks respectively are representative of the popular "6 db-per-octave attenuation" type. They are the simplest types to construct and provide an "easy" type to roll-off, that is, a gradual falling off of the frequencies. Where it is desired to provide sharper electrical attenuation of the signals going in to the speakers, then a 12 db system may be designed by doubling up the filter elements—not two capacitors where one exists, but instead pairing off an inductance with an already existing capacitor, and a capacitor with an existing inductance. (The initial value of these **pairs** will not be the same for the 12 db as for the 6 db network.)

As an illustration of the conversion of a 6 db to a 12 db network, let us again consider the case of the two-way system of Fig. 3 which is a 6 db-per-octave network, the slow type, and examine the tweeter section. The capacitor passes high frequencies to the tweeter, as determined by the normally decreasing impedance of the capacitor as the frequency is increased. There is no sharp "yes and no" line of demarcation where the capacitor passes and where it does not pass power on to the tweeter. The manner in which this power is transferred to the tweeter is a **gradual one** determined by the value of the capacitor in series with the tweeter. Some low frequencies below the crossover point will inevitably be transferred to the tweeter.

BY-PASSING THE LOWS

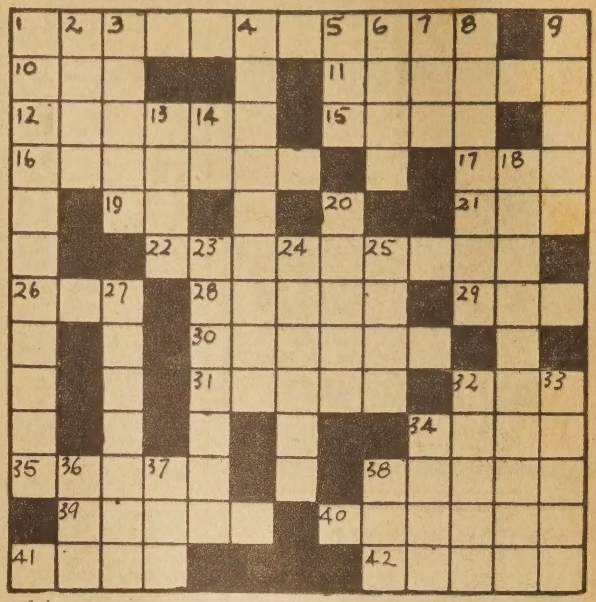
We can, however, **bypass** these low frequencies from the tweeter by shunting it with a choke, a **low-pass** element which has low impedance at low frequencies. Thus, if we have a tweeter in series with a capacitor, we may put a **choke across** the tweeter for faster roll-off at the low frequencies from the tweeter terminals, as shown in Fig. 6. As the frequency goes up, however, so will the impedance of the choke and the high frequencies that get passed on to the tweeter through the capacitor will not be bypassed from the tweeter by the choke.

In a similar manner, if a capacitor were to be put across the woofer terminals, it would bypass any high frequencies that might get through the choke to the woofer terminals and the high-frequency roll-off at the woofer would thus be faster than that provided by the choke itself. At the low frequencies the capacitor shunted across the woofer terminal would be relatively ineffective. It is thus possible to design a "fast" 12 db-per-octave network from a "slow" 6 db-per-octave network by simply adding, across each loudspeaker unit, a reactance element opposite in nature to that normally found in that particular branch of the circuit as a 6 db-per-octave network (but altered in value). Fig. 7 shows 12 db-per-octave counterparts of the simple 6 db-per-octave networks.

We have intentionally avoided reference to numerical values for these reactive elements because it was desirable to first establish a general speaking acquaintance with the principles behind these common network systems. We have indicated why they were necessary; we have briefly discussed how they function; and the general nature of the differences among the various types. We are now ready to assign values to the components used in the various filter elements.

(By arrangement with "Radio and TV News.")

THE R., TV & H. CROSSWORD No. 62



ACROSS

1. Steady voltage component at the cathode of a valve. (2 words)
10. Atmosphere.
11. Energetic.
12. Coil with base pins to fit into a socket.
15. Spool.
16. Having no tendency to take a fixed position.
17. Prefix meaning three.
19. Expression of greeting.
21. Charged atom.
22. Valves used for obtaining negative resistance.
26. A white metal.
28. Capital city of Ghana.
29. To obtain.
30. One of the planets.
31. Worn out.
32. To rest upon a chair.
34. General audio quality.
35. Mistake.
38. Discoverer of voltaism.
39. Merits by labour.
40. An expensive white metal.
41. To be inactive.
42. Vehicle used on snow or ice

DOWN

1. Property of a body, enabling it to accept and hold an electric charge.
2. Feels pain.
3. Conformity to fact.
4. Special carriage for meals (2 words).
5. Place in court for prisoners.
6. Frosted.
7. Consumed.
8. Obstructing with mud.
9. Product from the secretion of sap from trees.
13. Reverse of loss.
14. Demonstrative pronoun.
18. Special reddish pink colour (2 words).
20. To walk with a proud gait.
23. Pertaining to the east.
24. Performing dramatically.
25. Seldom occurring.
27. Opposite to active in an AC mains supply.
32. To clear up.
33. Separates by violence.
34. Tax paid for passing over a bridge.
36. Colour.
37. Mineral substance containing metal.
38. Force, power.

Solution and further crossword next month

Last month's solution

T	R	A	N	S	I	S	T	O	R	S	■	H
R	■	S	E	E	N	■	M	■	I	C	E	
A	T	T	E	N	U	A	T	I	O	N	■	A
N	E	A	R	E	R	■	T	■	C	A	T	
S	A	T	■	G	E	I	S	S	L	E	R	
D	■	I	R	A	D	E	■	I	■	M		
U	■	C	■	L	■	■	W	I	G	W	A	M
C	■	■	C	■	■	■	E	■	H	■	T	
E	C	H	O	E	F	F	E	C	T	■	U	
R	■	E	R	R	■	A	■	H	E	A	R	S
■	■	R	E	A	C	T	I	O	N	■	E	
■	■	■	T	■	S	■	E	■	K	■	■	
B	U	Z	Z	E	R	S	■	E	T	H	E	R

ANSWERS TO CORRESPONDENTS

R.I. (Maroochydore, Q.) writes to comment on the Serviceman's recent article on safety (or lack of it!) in a typical domestic radio receiver, and to relate one of his own experiences along similar lines.

A. Many thanks, R.I. and we will pass this letter on to the Serviceman for his possible use. The "trap" you describe is a very common one, the only saving feature being that a blown fuse is almost inevitable.

R.S.I. (Nunawading, Vic.) writes to offer his views on a recent "Argument" discussion concerning an Ohm's law problem.

A. Many thanks for your comments, R.S.I., and we have passed this letter on to the writer for possible comment and inclusion in the article. However, it may be that other subjects may have to take precedence in the next month or so.

J.P. (Orange, N.S.W.) is another reader who has experienced trouble with 6AM5 valves in a manner similar to that described in a recent Serviceman article.

A. Many thanks, J.P., and we will pass this letter on to the Serviceman for his possible use. We have no doubt that the interest in this subject will prompt him to make some further comment.

B.H.D. (Gunnedah, N.S.W.) asks for some special circuits.

A. We regret that we cannot help you beyond what has already been published. The fact that you ask for these circuits indicates that you have not appreciated the general principles and significance of the present stereophonic recordings and reproduction systems and we suggest that you read the articles on the subject in recent issues.

AWA RONETTE
MICROPHONES & ACCESSORIES

Types GS210. High Impedance
£9/19/
GS210/L. Low Impedance (200 ohms).
£15/3/3
Both models fitted with on-off switch.

NEWTON McLAREN
17 LEIGH ST., ADELAIDE.
(and leading wholesalers)

ALWAYS RELY ON R.D.S.

R D S

Stockists of Television parts, Picture Tubes and Turrets

We can supply all Radio and Electrical Components and are agents for the famous Hotpoint Radio Sets, Distributors of Test Equipment, valve and Circuit Tester, Multimeters, etc. A Complete Mail Order Service for the Countryman. Call, write, or phone to

The Independent Wholesaler
RADIO DESPATCH SERVICE
Radio and Electrical Distributors,
GROUND FLOOR, WEMBLEY HOUSE,
841 GEORGE STREET, SYDNEY.
Phone MA1876. Open Saturday Mornings

PRACTICAL HOME-STUDY
COURSE IN RADIO

STOTT'S Course meets the exact needs of Amateurs, Radio Salesmen, Experimenters, Dealers, Service Men, Builders of Sets and others.

This Popular Course has been designed and prepared by Experts.
A N.S.W Student wrote:—

"The Lessons are simply explained and any one, without any knowledge of Radio, can follow them quite easily."

Write today, without obligation, for particulars of the STOTT Course in RADIO FOR AMATEURS.

Stott's Correspondence College

159 Flinders Lane, Melbourne; 149 Castlereagh St., Sydney; 290 Adelaide St., Brisbane; 21 Grenfell St., Adelaide; 254 Murray St., Perth.

CUT HERE AND POST

To STOTT'S: Please send me, free and without obligation, full particulars of your Course —RADIO FOR AMATEURS.

My Name .....
Address .....
..... Age ..... (R.H. 659)

WANTED TO BUY, SELL OR EXCHANGE

FOR SALE: Leak pick-up, as new, £15/15/ Phone JW3194.

SALE: R. TV and H. Vol 1, No. 1 to Vol. 18 No. 12. Best offer. **Elliott, 4 Havlin Street, Bendigo, Victoria.**

SALE: Dual 1002 changer fitted with diamond L.P. stylus. £20. **N. Gilberthorpe, 5 Pine Road, Yennora.**

SALE: Back nos. R. and H. 2/ per copy. Two or more copies 1/6 each. 1956, 1957 copies 3/ each. 1958 copies 4/ each. Prices include postage. Wanted: 1939, 1940, 1953, 1954, 1955, 1956, 1957, and 1958. Best prices paid. **A. J. Cox, 13 Glover Street, Belmont, N.S.W.**

SELL: Goodmans 315 3-way speaker system with audiom bass unit, midax 400, trebax, 2 attenuators, crossover, and A.R.U. All fitted into correct polished enclosure supplied by United Radios. Only few weeks old. Absolutely as new. Cost £150 Will sacrifice at £95. **Ring FU9197 (Sydney).**

MODEL boiler B6 building kit. Blue print. Barrel and material, 98/9. **Bolton, 72 King Street, Sydney.** Catalogue 5/6.

SELL: 5in TV £10. R. and H. CRO £10. R. and H. VTVM £10. 5BP1 £2. Modulator unit for wobbulator £3. **R. Callander, 37 Everton Grove, Surrey Hills, Melbourne. WX4206.**

SELL: 6 Universal Radio-Valve tester, £5 each. **Metrop. Radio Supplies, Parramatta Road, Stanmore. LM7398.**

SELL: All back issues of R., TV and H. in stock at all times. 2/ per copy. Two or more copies 1/6 ea. 1956-57 copies 3/ ea.; 1958 copies for 4/ ea. All prices incl. post. **T. Weir, 56 O'Connor St., Haberfield, Sydney, N.S.W. UA2569.** Wanted to buy copies, any quantity.

SELL: Byer model T19B 16in transcoptn T.T. 33 and 45 R.P.M., £18. **Phone WX1450 Sydney after 6 p.m.**

SELL: Stereo Mullard approved 3-3's, only £33/10/. **Victoria. JB2820.**

WANTED: To buy, sell or exchange. Hi-fi equipment for better Mono and Stereo. **Victoria. JB2820.**

SELL: Bargains in Hi-Fi, New Co-axial Jensens Goodmans speakers less than half price. Also cabinets and Stereo amplifiers, etc., at unbeatable prices. **361 Bridge Road, Richmond, Victoria. JB2820.**

SELL: World famous make of moving coil diamond pick-up L.P. and 78. Adjustable arm. **JB2820, Melbourne.**

STEREO-ETTE: The new control unit for stereo crystal pick-ups. Add to your existing Monaural system for Stereo only £17/17/. Available from leading Hi Fi suppliers. With 2 Verdik 10 watt amplifiers. £82/5/. **Fonetta Electronics, 25 Wentworth Street, Parramatta. YL8231, Amplasound Co., 126 Buckingham Street, Sydney. XJ4193.**

IMPOVE the high frequency response of your Hi Fi system with a tweeter complete range: Lorenz electronic 16/3 and £1/7/6. Peerless 2in dynamic. £5/10/. Goodmans Trebax. £11/19/. Wharfedale super 3in. £13/12/4. Let us advise you. **Amplasound Co., 35 Lewis Street, Balgowlah. XJ4193, Fonetta Electronics, 25 Wentworth Street, Parramatta. YL8231.**

SELL: 300 cycle crossover suitable for stereo, £15. **Amplasound Co., 35 Lewis Street, Balgowlah.**

FOR good quality radio parts at bargain prices, write to **B. Beattie, Spencer, N.S.W.**

MUST SELL collection disposal goods. Meters, Relays, motors, camera etc. Stamp for list. **R. Argue, Box 12, P.O., Arncliffe, N.S.W.**

RADIO, Television Hobby Class, no exams. Friendly assistance. 7 p.m. Bondi-Waverley Public School. **Information MX1694.**

BASS reflex enclosure with A.R.U. and two 12in spkrs; £20. **WU7669 Melbourne.**

BE YOUR OWN BOSS

Make £10, £15 or £20 a week at home in your spare time. Send for details of my Guaranteed Money-making Plans. Special courses of instruction FREE. Don't miss this opportunity for extra cash.

Write NOW to Desk R.H., PROFIT ENTERPRISES (reg.), Box 5070, G.P.O., Sydney.

TAPE to DISC

7in 45 L.P.	Under 7 mins.	25/
7in 45 E.P.	Under 10 mins.	30/
10in 78 STD.	Under 7 mins.	35/
12in 78 STD.	Under 10 mins.	40/
10in 33 L.P.	Under 34 mins.	55/
12in 33 L.P.	Under 45 mins.	65/

★ SEND YOUR TAPE NOW!
SONIC LABORATORIES
Specialists in Studio and Outside Recording
FU3227. Box 2325 G.P.O. Sydney. FM3545
or call J STANLEY JOHNSTON PTY LTD 437 George Street, Sydney
★ Enclose instructions, cash, and 2/6 postage.

For PRINTING
CALL FF3911
SUNGRAVURE
Morley Ave., Rosebery.

Printed and published by Sungravure Ltd., at the registered office: 21-29 Morley Avenue, Rosebery N.S.W.

JF2550 JF2550

STANDARD RESISTOR CO

JF2550 JF2550

Specialists in the design and manufacture of wire-wound power resistors for trade and industry.

We can supply a full range of resistors in commercial and tropic proof coatings.

SPECIAL RESISTORS MADE TO ORDER

STANDARD RESISTOR CO. PTY. LTD.,
296A WILLOUGHBY RD., NAREMBURN, SYDNEY. JF2550